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Stereo Photo Series for Quantifying Natural Fuels

Volume II: Black Spruce and White Spruce Types in Alaska

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Stereo Photo Series for Quantifying Natural Fuels

Volume II: Black Spruce and White Spruce Types in Alaska

Roger D. Ottmar and Robert E. Vihnanek

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ABSTRACT

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Two series of single and stereo photographs display a range of natural conditions and fuel loadings in black spruce and white spruce ecosystem types in Alaska. Each group of photos includes inventory information summarizing vegetation composition, structure and loading, woody material loading and density by size class, forest floor depth and loading, and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

Keywords: Woody material, biomass, fuel loading, natural fuels, black spruce, *Picea mariana*, white spruce, *Picea glauca*, boreal forest, Alaska.

COOPERATORS

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CONTENTS

2 What is the Natural Fuels Photo Series?
3 Why is the Photo Series Needed?
3 How was the Photo Series Developed?
3 Photographs
4 Photograph and Information Arrangement
4 Site Information
4 Understory
4 Overstory
5 Forest Floor
5 Woody Material
5 Using the Photo Series
6 Species List
6 Metric Conversions
7 Literature Cited
10 Alaska Black Spruce Photo Series
40 Alaska White Spruce Photo Series

WHAT IS THE NATURAL FUELS PHOTO SERIES?

The natural fuels photo series is a collection of six volumes, each representing a region of the United States. Volume I includes sites in mixed-conifer, western juniper, sagebrush, and grassland ecosystem types in the interior Pacific Northwest. Volume II (this volume) includes sites in black spruce and white spruce ecosystem types in Alaska. Volume III includes sites in lodgepole pine, quaking aspen and gambel oak ecosystem types in the Rocky Mountains. Volume IV includes sites in pinyon-juniper, sagebrush, and chaparral ecosystem types in the Southwest. Volume V includes sites in red and white pine, northern tallgrass prairie, and hardwood ecosystem types in the Midwest. Volume VI includes sites in longleaf pine, pocosin, and marsh grass ecosystem types in the Southeast.

There are two to four series in each volume, each composed of between 4 and 17 sites. Generally, sites include standard, wide-angle, and stereo-pair photographs supplemented with information on living and dead fuels and vegetation, and where appropriate, stand structure and composition within the area visible in the photographs (fig. 1). This volume (volume II) includes sites in black spruce and white spruce ecosystem types in Alaska. The sites in this volume provide a basis for appraising and describing woody material, vegetation, and stand conditions in many areas across Alaska.

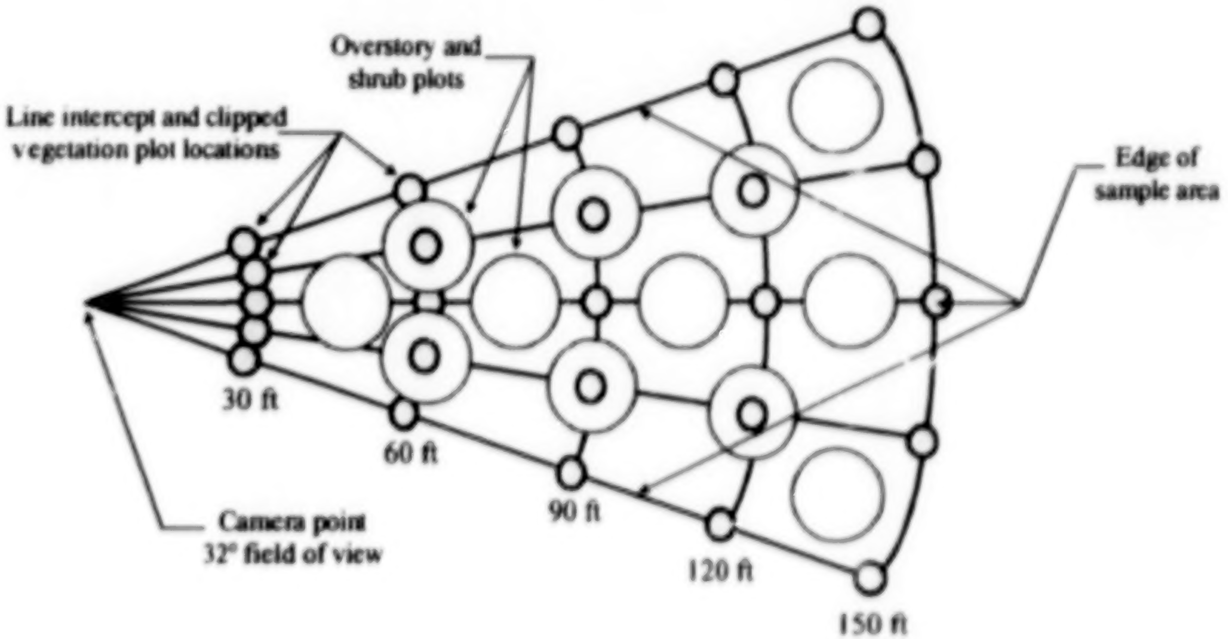
Overstory and shrub plots
Line intercept and clipped vegetation plot locations
Edge of sample area
30 ft
60 ft
90 ft
120 ft
150 ft
Camera point
32° field of view

Figure 1--Photo series sample area layout. Forty random azimuth line transects (one at each point on the 30 and 150 foot arcs, and two at each point on the 60, 90 and 120 foot arcs), and 12 clipped vegetation plots (two to three per arc) were located within the sample area. Trees and shrubs were inventoried on 12 systematically located sample plots. Seedlings were inventoried on smaller plots nested within the overstory and shrub plots.

WHY IS THE PHOTO SERIES NEEDED?

These photo series are important land management tools that can be used to ecologically assess landscapes through appraisal of living and dead woody material and vegetation (i.e., fuels) and stand characteristics. Once an ecological assessment has been completed, stand treatment options, such as prescribed fire or harvesting, can be planned and implemented to better achieve desired effects while minimizing negative impacts on other resources.

The photo series has application in several branches of natural resource science and management. Inventory data such as these can be used as inputs for evaluating animal and insect habitat, nutrient cycling, and microclimate, for example. Fire managers will find these data useful for predicting fuel consumption, smoke production, fire behavior, and fire effects during wildfires and prescribed fires. In addition, the photo series can be used to appraise carbon sequestration, an important factor in predictions of future climate, and to link remotely sensed signatures to live and dead fuels on the ground.

Ground inventory procedures that directly measure site conditions (e.g., fuel loading and arrangement, vegetation structure and composition, etc.) exist for most ecosystem types and are useful when a high degree of accuracy is required. However, ground inventory is time consuming and expensive. Photo series can be used to make quick, easy and inexpensive determinations of fuel quantities and stand conditions when less precise estimates are acceptable.

HOW WAS THE PHOTO SERIES DEVELOPED?

Sites photographed for the series in this volume were selected to show a range of conditions of several site attributes. Both the black spruce and white spruce sites represent a range of tree sizes and densities. In addition, the white spruce sites show a range of woody material loadings. Photographs were taken and fuel loading and stand inventory data were collected using the procedures of Maxwell and Ward (1980) as a guide.

PHOTOGRAPHS

Stereo-pair photographs are included in this guide. The three-dimensional image obtained by viewing the photographs with a stereoscope improves the ability of the land manager to appraise natural fuel, vegetation, and stand structure conditions. One larger photograph (wide-angle view) is included for additional comparisons. The marker in these photographs is a 1-foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide scale. The pole is 30 feet from the camera. The summary data relate to the field of view of the stereo-pair photographs but are based on measurements taken in the sample area only (see fig. 1). In addition, a forest floor profile photograph is included to supplement the summary data.

PHOTOGRAPH AND INFORMATION ARRANGEMENT

The photographs and accompanying data summaries are presented as single sites organized into two series. Each site is arranged to occupy two facing pages. The upper page contains wide-angle (50 mm) and forest floor profile photographs, general site information, and understory summary data. The lower page includes the stereo-pair photographs and summaries of overstory structure and composition, forest floor depth, loading and constancy, and dead and down woody material loading and density by size class.

SITE INFORMATION

The camera point of each site was located with a global positioning system (GPS) receiver using the WGS-84 datum. Elevations were derived from U.S. Geological Survey topographic maps. Cover type, an indicator of current vegetation composition, was assigned for each site (Eyre 1980). Vegetation type, corresponding to level IV in Viereck et al. (1992), is also noted as a measure of current vegetation composition. Major tree and tall shrub species present at a site are listed in order of abundance.[1] Soil type was determined from soil survey maps and descriptions (Rieger et al. 1979). Crown closure was measured with a spherical densiometer at 12 systematically located points in the sample area. The proportion of hardwood species present in the overstory is reported as a percentage of the total number of stems sampled in twelve 0.005-acre plots located systematically throughout the sample area (fig. 1). Total unit biomass is the sum of the understory biomass, aboveground mass, total forest floor loading, and total woody material loading on an area basis.[2]

UNDERSTORY

Understory vegetation was sampled in 12 square, clipped vegetation plots (2.69 square feet each) located systematically throughout the sample area (fig. 1). All low shrubs, grasses, and forbs growing within each square plot were clipped at ground level and returned to the laboratory for oven drying. Clipped understory vegetation was oven-dried at a minimum of 158 °F for at least 48 hours before weighing and determination of area loading. Tall shrubs and seedlings were censused and measured in, respectively, twelve 0.005-acre and 0.001-acre circular plots located systematically throughout the sample area (fig. 1). Tall shrub and seedling biomass values were calculated using allometric equations (Barney et al. 1978, Brown 1976, Roussopoulos and Loomis 1979, Telfer 1969).

OVERSTORY

Overstory trees were sampled in twelve 0.005-acre circular plots located systematically throughout the sample area; the overstory plots represented 43 percent of the total sample area (fig. 1). Tree measurement data were summarized by diameter at breast height (d.b.h.) size class and by tree status (all, live or dead).[3] Ladder fuel height was defined as the height of the lowest live or dead branch material that could carry fire into the crown of the tree, while height to live crown was the height of the lowest live branches of the continuous tree canopy. Live crown mass (branches and foliage) and aboveground mass (crown and stem) values were calculated from species-specific allometric equations (Barney et al. 1978; Harding and Grigal 1985; Roussopoulos and Loomis 1979; Singh 1981, 1984; Yarie and VanCleve 1983).

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[1] A list of scientific and common species names used in this volume appears on page 6.

[2] All biomass and loading values are reported on an oven-dry basis.

[3] D.b.h. is measured 4.5 feet above the ground.

FOREST FLOOR

Surface material and duff depth were calculated as the average of between 90 and 120 randomly distributed measurements taken throughout the sample area. The depth for the different surface material and duff types (i.e., moss, lichen, conifer litter, hardwood litter, upper duff, and lower duff) was calculated as an average of material depth only where that type was encountered during sampling. Therefore, the depths reported for the different surface material and duff types are not unit-wide averages and, as such, are not additive. Loading was calculated from bulk density values derived from field measurements. Constancy indicates how consistently the various forest floor types occur in the sample area and is expressed as a percentage of the total number of measurements.

WOODY MATERIAL

Measurement techniques used for inventorying dead and down woody material were patterned after the planar intersect method outlined by Brown (1974) and described by Maxwell and Ward (1980). Forty transects of random azimuth starting at 25 systematically located points within the sample area were used to determine woody material loading and density (fig. 1). Woody material data are reported by size classes that correspond to timelag fuel classes used in fire behavior modeling (see, for example, Burgan and Rothermel 1984).[4] Woody material in 10-hour and 100-hour and larger size classes was tallied on transects that were 10 feet and 30 feet long, respectively. Woody material loading in the 1-hour size class (i.e., ≤0.25 inch in diameter) was assumed to be 60 percent of 10-hour loading based on field observations. The decay class (sound or rotten) and the actual diameter at the point of intersection were measured for all pieces >3 inches in diameter. All woody material <3 inches in diameter was considered sound. Woody material loading and woody material density were calculated from relationships that use number of pieces intersected and transect length (and wood specific gravity for loading) developed by Brown (1974) and Safranyik and Linton (1987), respectively.

USING THE PHOTO SERIES

The natural fuels photo series is a tool for quickly and inexpensively evaluating a variety of fuel and vegetation conditions. Because of its ease of use, however, care must be taken when evaluating field sites to compare only with photo series sites that are appropriate matches. It is acceptable, however, to use data from more than one site from the photo series when evaluating a site in the field (e.g., woody material loading from one site in the photo series, and tree density from another site in the photo series to best match the conditions of a given field site).

Make a visual inventory of the site by observing fuel and stand conditions within the field of view and comparing them with the photographs as follows:

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[4] 1-hour, 10-hour and 100-hour fuels are defined as woody material ≤0.25 inch, 0.26-1.0 inch, and 1.1-3.0 inches, respectively.

- Observe each characteristic for a specific size class of woody material on the ground (e.g., >3.0-inch woody material loading).
- Select a photo series site (or sites) that nearly matches or brackets the observed characteristics.
- Obtain the quantitative value for the characteristic being estimated from the data summary accompanying the selected photo series site, or interpolate a value between sites.
- Repeat these steps for each size class or stand characteristic of interest.

The total loading or stand condition can then be calculated by summing the estimates. If the site being inventoried has areas with obvious differences in woody material or stand conditions, the user should make separate determinations for each area and then weight and cumulate the loading for the whole site.

Characteristics not distinguishable in the photographs are surface material and duff depth and proportions of sound and rotten material. If values for these characteristics are desired in the inventory, they must be derived from independent sampling or observations.

The 20 National Fire-Danger Rating System (Burgan 1988, Deeming et al. 1977) and the 13 fire behavior (Albini 1976) fuel models are very general in content and broadly applied, consequently, we chose not to assign one of these existing fuel models to individual sites in this photo series. The photo series was designed to provide sufficient fuel and vegetation data from which managers could generate their own customized fuel models.

SPECIES LIST

Scientific and common species names for trees and shrubs are from Viereck and Little (1972).

SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME	COMMON NAME
TREES		**SHRUBS**	
Betula papyrifera	Alaska paper birch	*Alnus crispa*	American green alder
Picea glauca	White spruce	*Alnus sinuata*	Sitka alder
Picea mariana	Black spruce	*Salix* spp.	Willow
Populus balsamifera	Balsam poplar		
Populus tremuloides	Quaking aspen		

METRIC CONVERSIONS

1 foot = 0.3048 meter
1 inch = 2.54 centimeters
1 acre = 0.4047 hectare
1 acre = 4046.9 square meters
1 square foot = 0.0929 square meter
1 pound = 0.4536 kilogram
1 ton = 0.9072 metric ton
1 ton = 907.2 kilograms

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ALASKA
BLACK SPRUCE PHOTO SERIES

A SERIES OF 14 SITES
BS 01 THROUGH BS 14

NOTES TO USERS:

1. The sites in this series are ordered primarily from smallest to largest average tree diameter at breast height (d.b.h.) and secondarily from highest to lowest tree density (i.e., if two or more sites have the same average tree d.b.h., the site with the highest tree density appears first).

2. A list of scientific and common names can be found on page 6.

3. The marker in these photographs is a 1-foot square, and the pole is painted in contrasting colors at 1-foot intervals. The pole is 30 feet from the camera.

4. The sample shown in the forest floor profile photograph was taken from a random location in the sample area and does not necessarily represent the reported average forest floor conditions.

5. In the overstory summary table, live crown mass includes foliage and branches, while aboveground mass includes foliage, branches, and the bole.

6. A distinction is made between rotten and sound woody material only for pieces larger than 3 inches in diameter.

7. Bulk density values used for calculating surface material loading from depth are:
   - Moss, lichen, and conifer litter: 2.9 tons·acre^{-1}·inch^{-1}
   - Hardwood litter: 2.3 tons·acre^{-1}·inch^{-1}
   - Grass: 0.30 ton·acre^{-1}·inch^{-1}

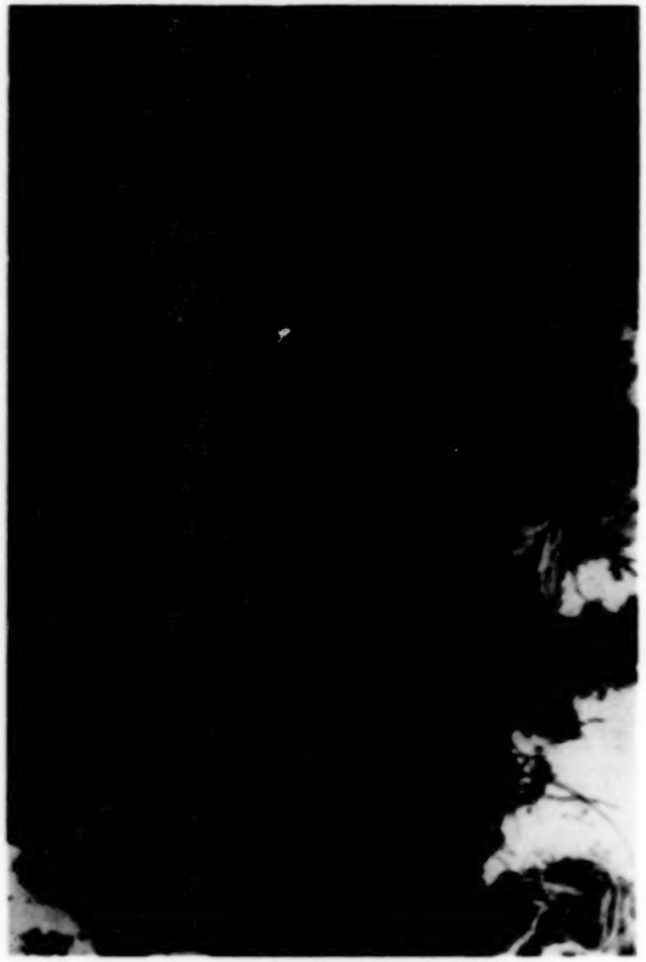
8. Bulk density values used for calculating duff loading from depth are:
   - Upper duff: 6.7 tons·acre^{-1}·inch^{-1}
   - Lower duff: 23.5 tons·acre^{-1}·inch^{-1}

9. Total unit biomass, woody material and forest floor loading, live crown mass, and aboveground mass are reported in tons per acre, while understory loadings are reported in pounds per acre.

BS 01 ALASKA BLACK SPRUCE

Wide view

Forest floor profile



SITE INFORMATION

Site location: N 63° 54' 33.83" W 145° 16' 18.40" 1,200 ft elevation

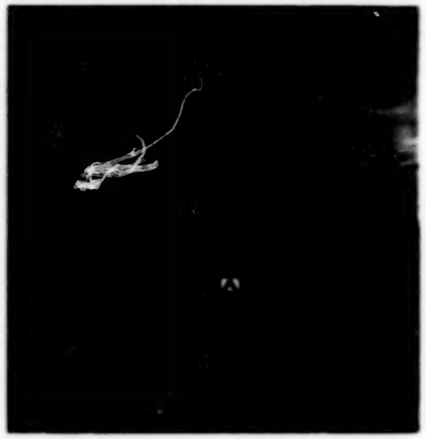
SAF covertype: Black Spruce
Vegetation type: Closed Black Spruce Forest
Species: *Picea mariana*, *Populus balsamifera*
Soil type: Typic Cryochrepts
Crown closure: 62% Hardwoods: 1% of stems

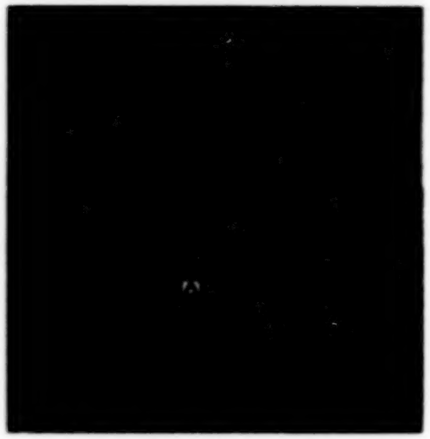
Total unit biomass: 105.45 tons/ac

UNDERSTORY

Tall shrub biomass: 0 lbs/ac Grass biomass: 21 lbs/ac
Low shrub biomass: 179 lbs/ac Forb biomass: 1 lb/ac
Seedling biomass: 1,372 lbs/ac
Total understory biomass: 1,573 lbs/ac

Tall shrubs: None
Density: 0/ac Standing dead: na Height: na
Seedlings: *Picea mariana*
Density: 11,985/ac Standing dead: 5% Height: 1.7 ft





OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	–	–	*Picea mariana*
Second most common species	*Populus balsamifera*	–	–	–	*Populus balsamifera*
Tree density (stems/ac)	7,984	420	0	0	8,404
Live	7,263	403	0	0	7,666
Dead	721	17	0	0	738
Avg DBH (in)	0.9	2.6	–	–	1.0
Live	1.0	2.6	–	–	1.1
Dead	0.6	3.2	–	–	0.7
Avg height (ft)	8.9	16.5	–	–	9.3
Live	9.1	16.3	–	–	9.5
Dead	7.1	20.0	–	–	7.4
Avg ladder fuel height (ft)	1.7	1.1	–	–	1.7
Live	1.7	1.0	–	–	1.6
Dead	2.5	4.0	–	–	2.5
Avg height to live crown (ft)	4.3	6.4	–	–	4.5
Live crown mass (tons/ac)	7.38	2.61	–	–	9.98
Aboveground mass (tons/ac)	11.35	3.65	–	–	14.99

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	2.0	5.80	100
Moss	2.0	5.70	98
Lichen	–	–	–
Conifer litter	1.6	0.10	2
Hardwood litter	–	–	–
Duff	7.0	81.57	100
Upper	6.5	43.66	100
Lower	2.5	37.91	64
Total Forest Floor	9.0	87.37	100

*Sample size (n) = 90

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.2	0.0	0.2	–	–	–
0.26 - 1.0	0.3	0.0	0.3	–	–	–
1.1 - 3.0	1.2	0.0	1.2	–	–	–
> 3.0	0.1	0.4	0.5	10	29	39
Total	1.9	0.4	2.3	10	29	39

BS 02 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 62° 06' 21.05" W 145° 30' 01.23" 1,400 ft elevation

SAF covertype: Black Spruce
Vegetation type: Open Black Spruce Forest
Species: *Picea mariana*
Soil type: Histic Pergelic Cryaquepts
Crown closure: 29% Hardwoods: 0% of stems

Total unit biomass: 184.73 tons/ac

UNDERSTORY

Tall shrub biomass: 0 lbs/ac Grass biomass: 21 lbs/ac
Low shrub biomass: 1,281 lbs/ac Forb biomass: 23 lbs/ac
Seedling biomass: 3,368 lbs/ac
Total understory biomass: 4,693 lbs/ac

Tall shrubs: None
Density: 0/ac Standing dead: na Height: na
Seedlings: *Picea mariana*
Density: 8,356/ac Standing dead: 44% Height: 2.4 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	--	--	*Picea mariana*
Second most common species	--	--	--	--	--
Tree density (stems/ac)	7,716	369	0	0	8,085
Live	6,810	319	0	0	7,129
Dead	906	50	0	0	956
Avg DBH (in)	0.9	2.4	--	--	1.0
Live	0.9	2.4	--	--	1.0
Dead	0.7	2.2	--	--	0.7
Avg height (ft)	8.0	15.5	--	--	8.3
Live	8.1	15.4	--	--	8.4
Dead	7.0	16.0	--	--	7.5
Avg ladder fuel height (ft)	0.9	0.4	--	--	0.9
Live	0.9	0.4	--	--	0.8
Dead	1.1	0.0	--	--	1.1
Avg height to live crown (ft)	4.7	7.4	--	--	4.8
Live crown mass (tons/ac)	8.10	1.80	--	--	9.89
Aboveground mass (tons/ac)	12.53	2.72	--	--	15.25

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	2.2	6.40	100
Moss	2.3	6.10	93
Lichen	1.5	0.30	7
Conifer litter	--	--	--
Hardwood litter	--	--	--
Duff	9.7	159.93	100
Upper	4.0	26.81	100
Lower	6.0	133.12	94
Total Forest Floor	11.9	166.33	100

*Sample size (n) = 102

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.1	0.0	0.1	--	--	--
0.26 - 1.0	0.1	0.0	0.1	--	--	--
1.1 - 3.0	0.6	0.0	0.6	--	--	--
> 3.0	0.0	0.0	0.0	0	0	0
Total	0.8	0.0	0.8	0	0	0

BS 03 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 64° 42' 06.73" W 147° 00' 47.50" 600 ft elevation

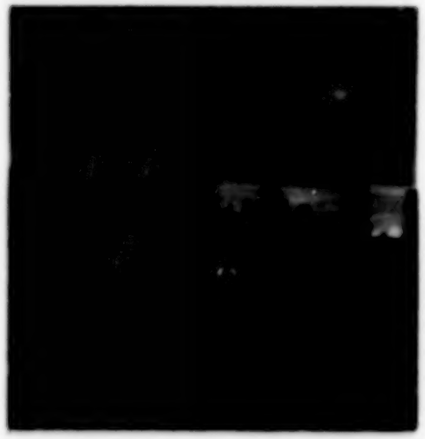
SAF covertype: Black Spruce
Vegetation type: Open Black Spruce Forest
Species: *Picea mariana*, *Salix* spp., *Alnus crispa*
Soil type: Histic Pergelic Cryaquepts - Typic Cryofluvents
Crown closure: 8% Hardwoods: 0% of stems

Total unit biomass: 184.60 tons/ac

UNDERSTORY

Tall shrub biomass: 336 lbs/ac Grass biomass: 101 lbs/ac
Low shrub biomass: 1,496 lbs/ac Forb biomass: 96 lbs/ac
Seedling biomass: 2,413 lbs/ac
Total understory biomass: 4,442 lbs/ac

Tall shrubs: *Salix* spp. and *Alnus crispa*
Density: 10,211/ac Standing dead: 19% Height: 1.9 ft
Seedlings: *Picea mariana*
Density: 5,149/ac Standing dead: 2% Height: 1.7 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	--	--	*Picea mariana*
Second most common species	--	--	--	--	--
Tree density (stems/ac)	1,342	101	0	0	1,443
Live	1,275	101	0	0	1,376
Dead	67	0	0	0	67
Avg DBH (in)	1.1	2.4	--	--	1.2
Live	1.1	2.4	--	--	1.2
Dead	1.0	--	--	--	1.0
Avg height (ft)	8.6	15.2	--	--	9.0
Live	8.6	15.2	--	--	9.1
Dead	8.0	--	--	--	8.0
Avg ladder fuel height (ft)	0.5	0.3	--	--	0.5
Live	0.5	0.3	--	--	0.5
Dead	1.0	--	--	--	1.0
Avg height to live crown (ft)	2.1	3.3	--	--	2.2
Live crown mass (tons/ac)	2.13	0.71	--	--	2.84
Aboveground mass (tons/ac)	3.12	0.95	--	--	4.07

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	4.0	11.53	100
Moss	4.0	11.53	100
Lichen	--	--	--
Conifer litter	--	--	--
Hardwood litter	--	--	--
Duff	9.8	166.38	100
Upper	3.8	25.43	100
Lower	6.1	140.96	98
Total Forest Floor	13.8	177.91	100

*Sample size (n) = 90

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.1	0.0	0.1	--	--	--
0.26 - 1.0	0.1	0.0	0.1	--	--	--
1.1 - 3.0	0.2	0.0	0.2	--	--	--
> 3.0	0.0	0.0	0.0	0	0	0
Total	0.4	0.0	0.4	0	0	0

BS 04 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 62° 06' 23.48" W 145° 30' 02.18" 1,390 ft elevation

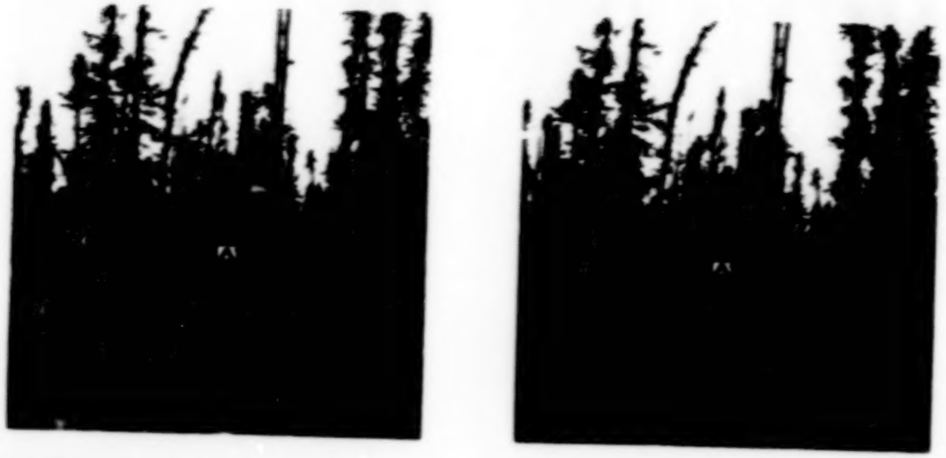
SAF covertype: Black Spruce
Vegetation type: Open Black Spruce Forest
Species: *Picea mariana*, *Salix* spp.
Soil type: Histic Pergelic Cryaquepts
Crown closure: 33% Hardwoods: 0% of stems

Total unit biomass: 184.62 tons/ac

UNDERSTORY

Tall shrub biomass: 704 lbs/ac Grass biomass: 73 lbs/ac
Low shrub biomass: 876 lbs/ac Forb biomass: 45 lbs/ac
Seedling biomass: 1,272 lbs/ac
Total understory biomass: 2,970 lbs/ac

Tall shrubs: *Salix* spp.
Density: 504/ac Standing dead: 27% Height: 9.6 ft
Seedlings: *Picea mariana*
Density: 4,642/ac Standing dead: 38% Height: 2.1 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	--	*Picea mariana*
Second most common species	--	--	--	--	--
Tree density (stems/ac)	4,764	655	50	0	5,469
Live	4,043	621	50	0	4,714
Dead	721	34	0	0	755
Avg DBH (in)	1.0	2.6	4.9	–	1.3
Live	1.0	2.7	4.9	–	1.3
Dead	1.0	2.4	–	–	1.1
Avg height (ft)	8.8	16.8	25.7	–	9.9
Live	8.7	16.8	25.7	–	10.0
Dead	8.9	16.5	–	–	9.2
Avg ladder fuel height (ft)	0.8	0.4	0.3	–	0.8
Live	0.9	0.4	0.3	–	0.8
Dead	0.6	0.0	–	–	0.6
Avg height to live crown (ft)	4.0	6.4	5.3	–	4.3
Live crown mass (tons/ac)	5.57	4.92	1.94	–	12.43
Aboveground mass (tons/ac)	8.94	6.68	2.34	–	17.96

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.5	4.45	100
Moss	1.6	4.43	98
Lichen	--	–	–
Conifer litter	0.7	0.02	1
Grass	0.8	<0.01	1
Duff	9.8	128.65	100
Upper	4.3	28.86	100
Lower	5.5	157.51	99
Total Forest Floor	11.3	161.97	100

*Sample size (n) = 90

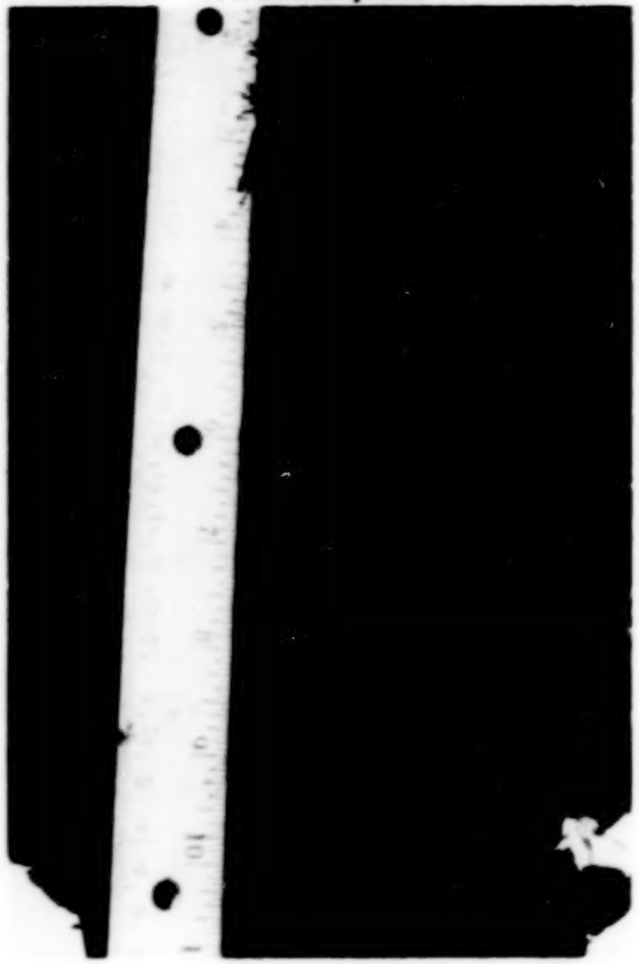
WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.2	0.0	0.2	–	–	--
0.26 - 1.0	0.4	0.0	0.4	–	–	–
1.1 - 3.0	1.4	0.0	1.4	–	–	–
> 3.0	0.7	0.6	1.2	58	54	112
Total	2.6	0.6	3.2	58	54	112

BS 05 ALASKA BLACK SPRUCE

Wide view

Forest floor profile



SITE INFORMATION

Site location: N 64° 41' 55.50" W 147° 00' 54.60" 600 ft elevation

SAF covertype: Black Spruce
Vegetation type: Closed Black Spruce Forest
Species: *Picea mariana*, *Salix* spp., *Betula papyrifera*
Soil type: Histic Pergelic Cryaquepts - Typic Cryofluvents
Crown closure: 59%
Hardwoods: 3% of stems

Total unit biomass: 61.13 tons/ac

UNDERSTORY

Tall shrub biomass: 766 lbs/ac
Grass biomass: 25 lbs/ac
Low shrub biomass: 1,043 lbs/ac
Forb biomass: 45 lbs/ac
Seedling biomass: 525 lbs/ac
Total understory biomass: 2,404 lbs/ac

Tall shrubs: *Salix* spp.
Density: 454/ac Standing dead: 32% Height: 7.7 ft
Seedlings: *Picea mariana*
Density: 5,908/ac Standing dead: 0% Height: 1.9 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	–	–	*Picea mariana*
Second most common species	*Betula papyrifera*	*Betula papyrifera*	–	–	*Betula papyrifera*
Tree density (stems/ac)	3,271	1,090	0	0	4,361
Live	2,919	1,040	0	0	3,959
Dead	352	50	0	0	402
Avg DBH (in)	0.9	2.5	–	–	1.3
Live	0.8	2.5	–	–	1.3
Dead	1.1	2.4	–	–	1.3
Avg height (ft)	9.0	19.8	–	–	11.7
Live	9.1	20.4	–	–	12.0
Dead	8.4	7.0	–	–	8.2
Avg ladder fuel height (ft)	1.6	2.4	–	–	1.8
Live	1.6	2.4	–	–	1.8
Dead	2.3	–	–	–	2.3
Avg height to live crown (ft)	2.9	5.3	–	–	3.5
Live crown mass (tons/ac)	2.52	6.52	–	–	9.04
Aboveground mass (tons/ac)	4.09	9.16	–	–	13.25

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	2.5	7.29	100
Moss	2.5	7.26	99
Lichen	–	–	–
Conifer litter	0.7	0.02	1
Hardwood litter	–	–	–
Duff	4.6	38.19	100
Upper	4.1	27.48	100
Lower	1.7	10.71	27
Total Forest Floor	7.1	45.48	100

*Sample size (n) = 90

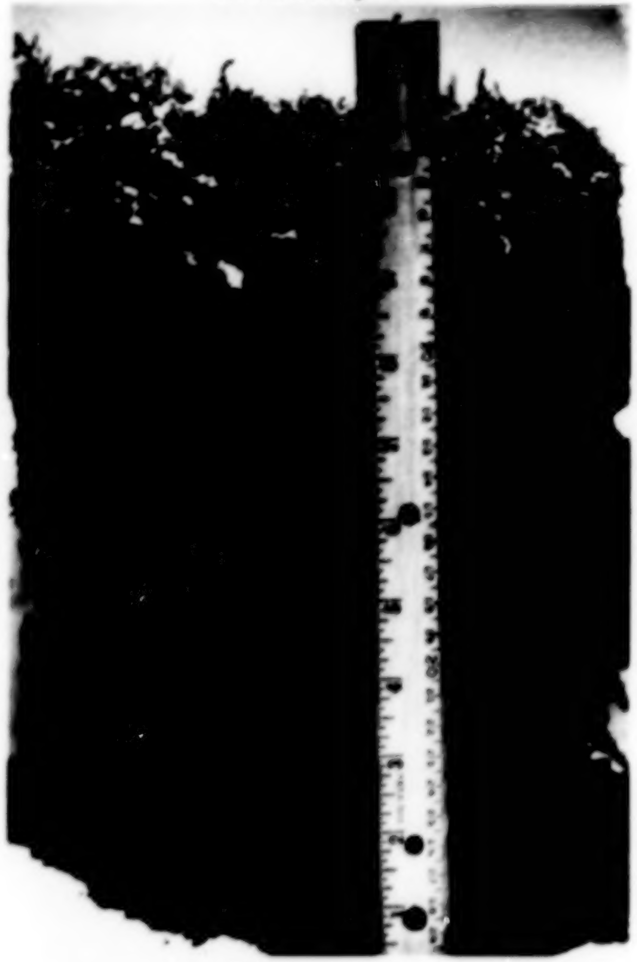
WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.1	0.0	0.1	–	–	–
0.26 - 1.0	0.2	0.0	0.2	–	–	–
1.1 - 3.0	0.8	0.0	0.8	–	–	–
> 3.0	<0.1	0.0	<0.1	5	0	5
Total	1.2	0.0	1.2	5	0	5

BS 06 ALASKA BLACK SPRUCE

Wide view

Forest floor profile



SITE INFORMATION

Site location: N 60° 26' 44.34" W 150° 18' 47.80" 390 ft elevation

SAF covertype: Black Spruce
Vegetation type: Closed Black Spruce Forest
Species: *Picea mariana*, *Salix* spp., *Betula papyrifera*
Soil type: Typic Cryorthods
Crown closure: 52% Hardwoods: 0% of stems

Total unit biomass: 81.69 tons/ac

UNDERSTORY

Tall shrub biomass: 487 lbs/ac Grass biomass: 4 lbs/ac
Low shrub biomass: 273 lbs/ac Forb biomass: 691 lbs/ac
Seedling biomass: 333 lbs/ac
Total understory biomass: 1,788 lbs/ac

Tall shrubs: *Salix* spp.
Density: 6,684/ac Standing dead: 0% Height: 1.5 ft
Seedlings: *Picea mariana* and *Betula papyrifera*
Density: 4,051/ac Standing dead: 0% Height: 1.6 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	--	*Picea mariana*
Second most common species	--	--	--	--	--
Tree density (stems/ac)	2,768	1,493	101	--	4,362
Live	2,701	1,292	101	--	4,094
Dead	67	201	0	--	268
Avg DBH (in)	1.1	2.7	4.4	--	1.7
Live	1.1	2.8	4.4	--	1.7
Dead	1.2	2.6	--	--	2.3
Avg height (ft)	10.1	19.5	28.2	--	13.7
Live	10.1	20.4	28.2	--	13.8
Dead	10.4	13.3	--	--	12.6
Avg ladder fuel height (ft)	0.5	0.9	1.1	--	0.6
Live	0.5	0.9	1.1	--	0.6
Dead	1.0	0.8	--	--	0.8
Avg height to live crown (ft)	3.4	7.2	5.3	--	4.7
Live crown mass (tons/ac)	3.37	12.00	2.70	--	18.07
Aboveground mass (tons/ac)	5.03	17.47	3.32	--	25.82

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	3.4	9.94	100
Moss	3.5	9.92	99
Lichen	--	--	--
Conifer litter	0.6	0.02	1
Hardwood litter	--	--	--
Duff	6.0	44.04	100
Upper	5.8	38.69	100
Lower	3.8	5.36	6
Total Forest Floor	9.4	53.98	100

*Sample size (n) = 100

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.1	0.0	0.1	--	--	--
0.26 - 1.0	0.2	0.0	0.2	--	--	--
1.1 - 3.0	0.5	0.0	0.5	--	--	--
> 3.0	0.1	0.1	0.2	10	5	15
Total	0.9	0.1	1.0	10	5	15

BS 07 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 63° 49' 56.92" W 144° 58' 57.98" 1,360 ft elevation

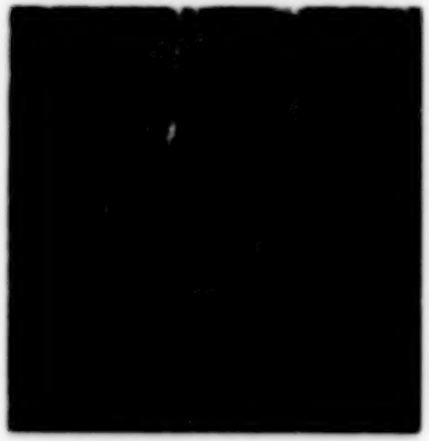
SAF covertype: Black Spruce
Vegetation type: Closed Black Spruce Forest
Species: *Picea mariana, Salix* spp., *Populus tremuloides*
Soil type: Typic Cryochrepts
Crown closure: 82% Hardwoods: 3% of stems

Total unit biomass: 119.94 tons/ac

UNDERSTORY

Tall shrub biomass:	1,279 lbs/ac	Grass biomass:	37 lbs/ac
Low shrub biomass:	266 lbs/ac	Forb biomass:	1 lb/ac
Seedling biomass:	138 lbs/ac		
Total understory biomass:	1,721 lbs/ac		

Tall shrubs: *Salix* spp
Density: 252/ac Standing dead: 55% Height: 11.5 ft
Seedlings: *Picea mariana*
Density: 1,097/ac Standing dead: 54% Height: 1.5 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	–	*Picea mariana*
Second most common species	*Populus tremuloides*	*Populus tremuloides*	*Populus tremuloides*	–	*Populus tremuloides*
Tree density (stems/ac)	3,154	2,634	218	0	6,006
Live	1,292	2,332	168	0	3,792
Dead	1,862	302	50	0	2,214
Avg DBH (in)	1.1	2.8	4.5	–	2.0
Live	1.4	2.8	4.4	–	2.4
Dead	0.9	2.8	4.6	–	1.2
Avg height (ft)	14.1	25.8	27.5	–	19.7
Live	17.1	26.5	31.6	–	23.5
Dead	11.9	19.8	14.0	–	13.1
Avg ladder fuel height (ft)	3.9	3.9	2.6	–	3.8
Live	3.7	3.8	2.5	–	3.7
Dead	4.1	4.6	3.0	–	4.1
Avg height to live crown (ft)	11.6	18.5	21.0	–	16.3
Live crown mass (tons/ac)	1.76	19.01	4.66	–	25.43
Aboveground mass (tons/ac)	3.90	27.87	7.74	–	39.52

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	2.6	7.40	100
Moss	2.6	7.40	100
Lichen	–	–	–
Conifer litter	–	–	–
Hardwood litter	–	–	–
Duff	6.0	70.47	100
Upper	4.2	28.19	100
Lower	2.8	42.28	63
Total Forest Floor	8.6	77.86	100

*Sample size (n) = 90

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.2	0.0	0.2	–	–	–
0.26 - 1.0	0.4	0.0	0.4	–	–	–
1.1 - 3.0	0.8	0.0	0.8	–	–	–
> 3.0	0.2	0.1	0.3	15	15	30
Total	1.5	0.1	1.7	15	15	30

BS 08 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 60° 28' 37.76" W 151° 01' 04.56" 100 ft elevation

SAF covertype: Black Spruce
Vegetation type: Closed Black Spruce Forest
Species: *Picea mariana*, *Picea glauca*, *Salix* spp.
Soil type: Typic Cryorthods
Crown closure: 58% Hardwoods: 0% of stems

Total unit biomass: 116.29 tons/ac

UNDERSTORY

Tall shrub biomass: 25 lbs/ac Grass biomass: 0 lbs/ac
Low shrub biomass: 86 lbs/ac Forb biomass: 627 lbs/ac
Seedling biomass: 340 lbs/ac
Total understory biomass: 1,078 lbs/ac

Tall shrubs: *Salix* spp.
Density: 17/ac Standing dead: 0% Height: 5.0 ft
Seedlings: *Picea mariana*
Density: 2,919/ac Standing dead: 3% Height: 1.7 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	*Picea mariana*	*Picea mariana*
Second most common species	–	*Picea glauca*	*Picea glauca*	–	*Picea glauca*
Tree density (stems/ac)	1,141	637	318	17	2,113
Live	923	520	268	0	1,711
Dead	218	117	50	17	402
Avg DBH (in)	1.1	2.9	5.3	9.6	2.3
Live	1.0	3.0	5.2	–	2.3
Dead	1.2	2.5	5.5	9.6	2.5
Avg height (ft)	9.0	23.2	34.8	21.0	17.3
Live	8.8	24.8	35.3	–	17.8
Dead	9.6	16.4	32.7	21.0	15.0
Avg ladder fuel height (ft)	0.4	0.6	0.1	5.0	0.4
Live	0.4	0.4	0.1	–	0.3
Dead	0.3	1.6	0.0	5.0	0.9
Avg height to live crown (ft)	2.0	4.7	3.6	–	3.1
Live crown mass (tons/ac)	0.87	5.61	11.44	–	17.92
Aboveground mass (tons/ac)	1.74	7.93	15.86	4.74	30.27

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	2.4	6.80	100
Moss	2.4	6.79	99
Lichen	–	–	–
Conifer litter	0.4	0.01	1
Hardwood litter	–	–	–
Duff	5.1	75.49	100
Upper	2.7	17.96	100
Lower	3.1	57.53	79
Total Forest Floor	7.5	82.28	100

*Sample size (n) = 100

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.1	0.0	0.1	–	–	–
0.26 - 1.0	0.2	0.0	0.2	–	–	–
1.1 - 3.0	0.5	0.0	0.5	–	–	–
> 3.0	1.5	0.9	2.4	58	24	82
Total	2.3	0.9	3.2	58	24	82

BS 09 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 60° 38' 51.50" W 150° 15' 06.95" 440 ft elevation

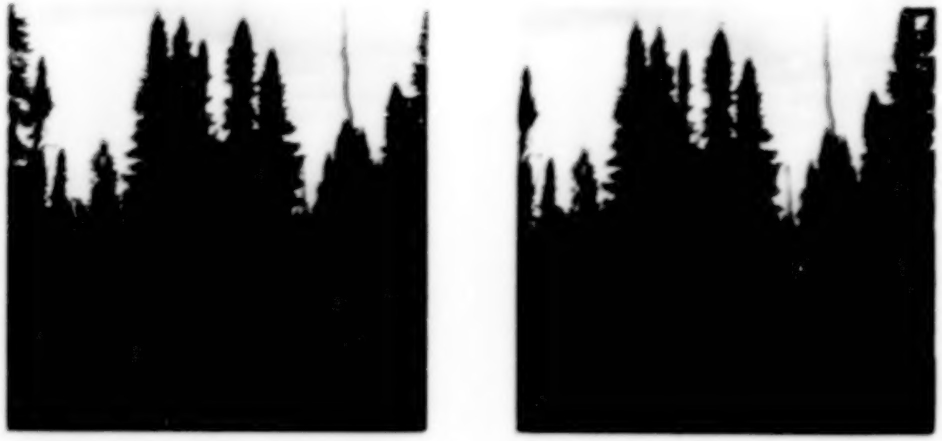
SAF covertype: Black Spruce
Vegetation type: Closed Black Spruce Forest
Species: *Picea mariana, Betula papyrifera, Salix* spp., *Populus tremuloides*
Soil type: Typic Cryorthods
Crown closure: 31% Hardwoods: 17% of stems

Total unit biomass: 155.46 tons/ac

UNDERSTORY

Tall shrub biomass: 444 lbs/ac Grass biomass: 0 lbs/ac
Low shrub biomass: 815 lbs/ac Forb biomass: 1,048 lbs/ac
Seedling biomass: 1,052 lbs/ac
Total understory biomass: 3,359 lbs/ac

Tall shrubs: *Salix* spp.
Density: 202/ac Standing dead: 0% Height: 4.5 ft
Seedlings: *Picea mariana, Betula papyrifera* and *Populus tremuloides*
Density: 4,304/ac Standing dead: 0% Height: 2.1 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	*Picea mariana*	*Picea mariana*
Second most common species	*Betula papyrifera*	*Betula papyrifera*	--	--	*Betula papyrifera*
Tree density (stems/ac)	1,358	1,242	671	34	3,305
Live	1,308	1,225	637	17	3,187
Dead	50	17	34	17	118
Avg DBH (in)	1.2	3.0	5.4	11.3	2.8
Live	1.2	3.0	5.4	11.5	2.8
Dead	1.2	2.7	5.4	11.0	4.0
Avg height (ft)	6.0	10.2	16.3	32.5	9.9
Live	6.0	10.2	16.4	40.0	9.9
Dead	5.3	10.0	14.0	25.0	11.3
Avg ladder fuel height (ft)	na	na	na	na	na
Live	na	na	na	na	na
Dead	na	na	na	na	na
Avg height to live crown (ft)	na	na	na	na	na
Live crown mass (tons/ac)	6.25	21.15	39.30	6.02	72.72
Aboveground mass (tons/ac)	8.16	26.58	47.90	9.77	92.41

FOREST FLOOR

	Depth[*] (in)	Loading (tons/ac)	Constancy[*] (percent)
Surface material	1.2	3.37	100
Moss	1.1	2.57	78
Lichen	1.9	0.39	7
Conifer litter	1.2	0.21	6
Hardwood litter	1.0	0.20	9
Duff	3.5	49.51	100
Upper	1.9	13.04	100
Lower	2.1	36.47	75
Total Forest Floor	4.7	52.87	100

[*] Sample size (n) = 100

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.2	0.0	0.2	–	–	–
0.26 - 1.0	0.4	0.0	0.4	–	–	–
1.1 - 3.0	2.0	0.0	2.0	–	–	–
> 3.0	1.4	4.5	5.9	78	287	365
Total	4.0	4.5	8.5	78	287	365

BS 10 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 62° 06' 20.72" W 145° 30' 26.01" 1,360 ft elevation

SAF covertype: Black Spruce - White Spruce
Vegetation type: Open Black Spruce - White Spruce Forest
Species: *Picea mariana*, *Picea glauca*, *Salix* spp
Soil type: Histic Pergelic Cryaquepts
Crown closure: 21% Hardwoods: 0% of stems

Total unit biomass: 151.80 tons/ac

UNDERSTORY

Tall shrub biomass: 519 lbs/ac Grass biomass: 51 lbs/ac
Low shrub biomass: 932 lbs/ac Forb biomass: 601 lbs/ac
Seedling biomass: 1,035 lbs/ac
Total understory biomass: 3,138 lbs/ac

Tall shrubs: *Salix* spp.
Density: 6,231/ac Standing dead: 28% Height: 5.1 ft
Seedlings: *Picea mariana* and *Picea glauca*
Density: 844/ac Standing dead: 50% Height: 2.3 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea glauca*	*Picea mariana*	*Picea glauca*	*Picea glauca*
Second most common species	*Picea glauca*	*Picea mariana*	*Picea glauca*	--	*Picea mariana*
Tree density (stems/ac)	369	235	118	17	739
Live	319	201	101	17	637
Dead	50	34	17	0	101
Avg DBH (in)	1.3	2.9	6.2	9.1	2.8
Live	1.3	2.8	6.2	9.1	2.8
Dead	1.1	3.5	6.4	--	2.8
Avg height (ft)	8.7	17.8	33.3	37.0	16.2
Live	9.1	17.4	33.2	37.0	16.2
Dead	6.7	20.0	34.0	--	15.7
Avg ladder fuel height (ft)	0.1	1.1	2.3	3.0	0.8
Live	0.1	1.0	2.2	3.0	0.8
Dead	0.0	1.5	3.0	--	1.0
Avg height to live crown (ft)	3.3	4.8	11.7	10.0	5.2
Live crown mass (tons/ac)	0.77	2.13	6.73	2.07	11.70
Aboveground mass (tons/ac)	1.12	3.43	9.45	2.80	16.80

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	2.1	6.09	100
Moss	2.2	5.45	87
Lichen	2.2	0.38	6
Conifer litter	--	--	--
Hardwood litter	1.6	0.26	7
Duff	9.1	125.84	100
Upper	5.3	35.24	100
Lower	4.1	90.60	93
Total Forest Floor	11.2	131.93	100

*Sample size (n) = 100

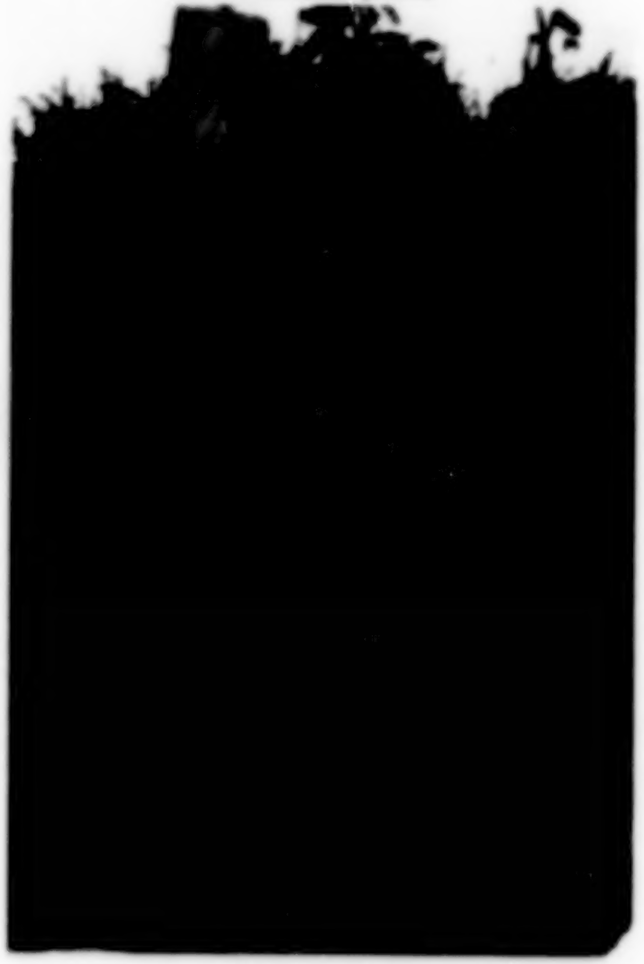
WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.1	0.0	0.1	--	--	--
0.26 - 1.0	0.2	0.0	0.2	--	--	--
1.1 - 3.0	0.1	0.0	0.1	--	--	--
> 3.0	1.0	0.2	1.2	24	15	39
Total	1.3	0.2	1.5	24	15	39

BS 11 ALASKA BLACK SPRUCE

Wide view

Forest floor profile



SITE INFORMATION

Site location: N 63° 54' 25.31" W 145° 15' 25.68" 1,200 ft elevation

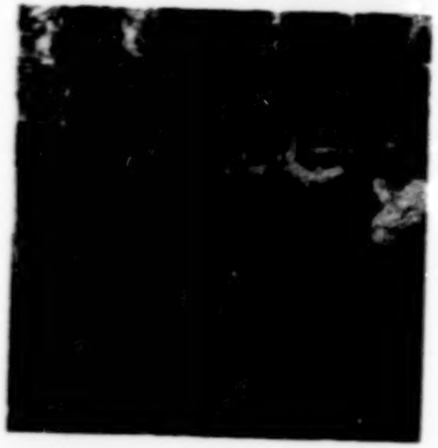
SAF covertype: Black Spruce
Vegetation type: Closed Black Spruce Forest
Species: *Picea mariana, Populus balsamifera, Populus tremuloides*
Soil type: Typic Cryochrepts
Crown closure: 78% Hardwoods: 4% of stems

Total unit biomass: 95.34 tons/ac

UNDERSTORY

Tall shrub biomass: 0 lbs/ac Grass biomass: 0 lbs/ac
Low shrub biomass: 423 lbs/ac Forb biomass: 1 lb/ac
Seedling biomass: 369 lbs/ac
Total understory biomass: 793 lbs/ac

Tall shrubs: None
Density: 0/ac Standing dead: na Height: na
Seedlings: *Picea mariana*
Density: 11,225/ac Standing dead: na Height: 0.9 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	–	*Picea mariana*
Second most common species	–	*Populus tremuloides*	*Populus balsamifera*	–	*Populus tremuloides*
Tree density (stems/ac)	805	1,576	487	0	2,868
Live	419	1,241	470	0	2,130
Dead	386	335	17	0	738
Avg DBH (in)	1.2	3.2	4.9	–	2.9
Live	1.3	3.2	4.9	–	3.2
Dead	1.2	3.0	4.1	–	2.1
Avg height (ft)	12.5	22.5	29.2	–	20.8
Live	15.3	24.2	29.4	–	23.6
Dead	9.5	16.5	25.0	–	13.0
Avg ladder fuel height (ft)	1.1	1.0	2.6	–	1.3
Live	1.5	1.1	2.7	–	1.5
Dead	0.5	0.7	0.0	–	0.6
Avg height to live crown (ft)	6.3	15.1	17.7	–	13.9
Live crown mass (tons/ac)	0.58	12.72	15.80	–	29.10
Aboveground mass (tons/ac)	1.35	19.77	18.99	–	40.11

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	2.5	7.36	100
Moss	2.6	7.08	93
Lichen	–	–	–
Conifer litter	1.7	0.27	6
Hardwood litter	0.4	0.01	1
Duff	4.9	46.07	100
Upper	4.1	27.76	100
Lower	1.9	18.31	40
Total Forest Floor	7.4	53.43	100

*Sample size (n) = 90

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.1	0.0	0.1	–	–	–
0.26 - 1.0	0.2	0.0	0.2	–	–	–
1.1 - 3.0	0.4	0.0	0.4	–	–	–
> 3.0	0.4	0.3	0.7	34	19	53
Total	1.1	0.3	1.4	34	19	53

BS 12 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 62° 06' 23.16" W 145° 30' 29.92" 1,360 ft elevation

SAF covertype: Black Spruce
Vegetation type: Closed Black Spruce Forest
Species: *Picea mariana*, *Salix* spp.
Soil type: Histic Pergelic Cryaquepts
Crown closure: 63% Hardwoods: 0% of stems

Total unit biomass: 179.83 tons/ac

UNDERSTORY

Tall shrub biomass: 2,031 lbs/ac Grass biomass: 219 lbs/ac
Low shrub biomass: 1,249 lbs/ac Forb biomass: 0 lbs/ac
Seedling biomass: 238 lbs/ac
Total understory biomass: 3,737 lbs/ac

Tall shrubs: *Salix* spp.
Density: 4,728/ac Standing dead: 14% Height: 7.3 ft
Seedlings: *Picea mariana*
Density: 3,882/ac Standing dead: 0% Height: 1.2 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	--	*Picea mariana*
Second most common species	--	--	--	--	--
Tree density (stems/ac)	755	487	420	0	1,662
Live	369	386	403	0	1,158
Dead	386	101	17	0	504
Avg DBH (in)	1.0	3.0	5.9	--	2.9
Live	0.9	3.1	5.9	--	3.4
Dead	1.2	2.7	5.8	--	1.7
Avg height (ft)	9.1	21.4	33.7	--	18.9
Live	8.2	23.2	34.2	--	22.2
Dead	9.9	14.3	22.0	--	11.2
Avg ladder fuel height (ft)	0.8	0.8	1.0	--	0.9
Live	0.6	0.8	1.0	--	0.8
Dead	0.9	0.8	3.0	--	1.0
Avg height to live crown (ft)	2.7	10.6	14.3	--	9.4
Live crown mass (tons/ac)	0.48	4.90	26.32	--	31.70
Aboveground mass (tons/ac)	1.42	7.11	31.28	--	39.81

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.8	5.31	100
Moss	1.9	4.90	88
Lichen	1.5	0.09	2
Conifer litter	0.9	0.05	2
Hardwood litter	1.5	0.28	8
Duff	9.3	132.23	100
Upper	5.1	34.10	100
Lower	4.3	98.14	96
Total Forest Floor	11.1	137.55	100

*Sample size (n) = 100

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.2	0.0	0.2	--	--	--
0.26 - 1.0	0.3	0.0	0.3	--	--	--
1.1 - 3.0	0.1	0.0	0.1	--	--	--
> 3.0	0.0	<0.1	<0.1	0	5	5
Total	0.5	<0.1	0.6	0	5	5

BS 13 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 61° 33' 13.73" W 145° 14' 22.03" 1,810 ft elevation

SAF covertype: Black Spruce
Vegetation type: Open Black Spruce Forest
Species: *Picea mariana*, *Salix* spp
Soil type: Typic Cryochrepts
Crown closure: 6% Hardwoods: 0% of stems

Total unit biomass: 86.96 tons/ac

UNDERSTORY

Tall shrub biomass: 285 lbs/ac Grass biomass: 19 lbs/ac
Low shrub biomass: 1,195 lbs/ac Forb biomass: 35 lbs/ac
Seedling biomass: 483 lbs/ac
Total understory biomass: 2,017 lbs/ac

Tall shrubs: *Salix* spp
Density: 3,070/ac Standing dead: 2% Height: 2.9 ft
Seedlings: *Picea mariana*
Density: 8,271/ac Standing dead: 0% Height: 1.0 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	--	*Picea mariana*
Second most common species	--	--	--	--	--
Tree density (stems/ac)	185	134	352	0	671
Live	151	0	67	0	218
Dead	34	134	285	0	453
Avg DBH (in)	0.8	3.3	5.4	--	3.7
Live	0.6	--	4.3	--	1.7
Dead	1.8	3.3	5.6	--	4.6
Avg height (ft)	7.8	19.1	24.9	--	19.1
Live	6.3	--	23.0	--	11.5
Dead	14.5	19.1	25.4	--	22.7
Avg ladder fuel height (ft)	0.6	2.6	1.9	--	1.7
Live	0.3	--	3.8	--	1.4
Dead	2.0	2.6	1.5	--	1.8
Avg height to live crown (ft)	0.8	--	6.7	--	2.3
Live crown mass (tons/ac)	0.12	--	1.82	--	1.95
Aboveground mass (tons/ac)	0.28	1.88	17.21	--	19.36

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	2.1	6.12	100
Moss	2.5	5.55	77
Lichen	--	--	--
Conifer litter	0.9	0.56	22
Hardwood litter	0.9	0.02	1
Duff	4.4	48.37	100
Upper	3.2	21.68	100
Lower	2.8	26.69	40
Total Forest Floor	6.5	54.49	100

*Sample size (n) = 90

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.3	0.0	0.3	--	--	--
0.26 - 1.0	0.5	0.0	0.5	--	--	--
1.1 - 3.0	1.5	0.0	1.5	--	--	--
> 3.0	7.6	2.2	9.8	360	122	482
Total	9.9	2.2	12.1	360	122	482

BS 14 ALASKA BLACK SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 61° 32' 05.42" W 145° 14' 04.79" 1,800 ft elevation

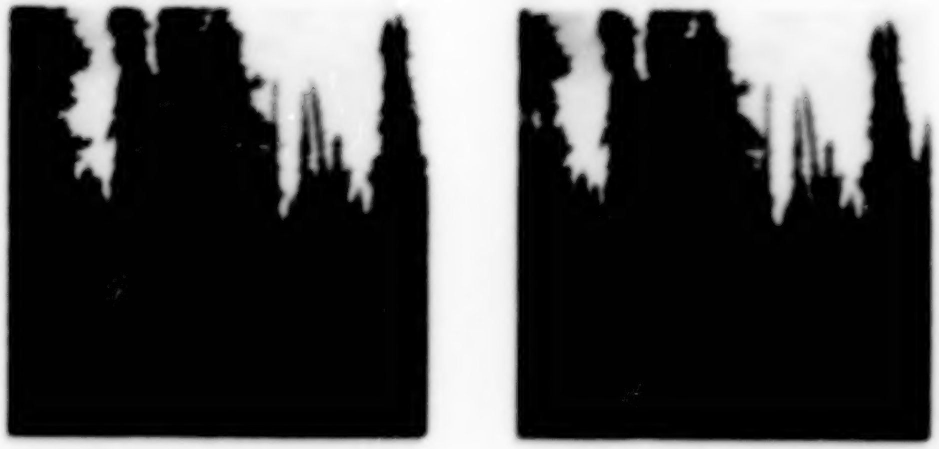
SAF covertype: Black Spruce
Vegetation type: Open Black Spruce Forest
Species: *Picea mariana*, *Salix* spp.
Soil type: Typic Cryochrepts
Crown closure: 22% Hardwoods: 0% of stems

Total unit biomass: 132.74 tons/ac

UNDERSTORY

Tall shrub biomass: 2,269 lbs/ac Grass biomass: 7 lbs/ac
Low shrub biomass: 2,530 lbs/ac Forb biomass: 83 lbs/ac
Seedling biomass: 240 lbs/ac
Total understory biomass: 5,129 lbs/ac

Tall shrubs: *Salix* spp.
Density: 10,793/ac Standing dead: 8% Height: 5.4 ft
Seedlings: *Picea mariana*
Density: 1,772/ac Standing dead: 0% Height: 1.6 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea mariana*	*Picea mariana*	*Picea mariana*	*Picea mariana*	*Picea mariana*
Second most common species	–	–	–	–	–
Tree density (stems/ac)	101	84	134	34	353
Live	101	84	67	0	252
Dead	0	0	67	34	101
Avg DBH (in)	0.7	2.5	6.7	10.4	4.3
Live	0.7	2.5	6.3	–	2.8
Dead	–	–	7.2	10.4	8.3
Avg height (ft)	7.0	14.2	28.9	41.5	20.3
Live	7.0	14.2	22.0	–	13.4
Dead	–	–	35.8	41.5	37.7
Avg ladder fuel height (ft)	0.3	0.4	0.5	1.5	0.5
Live	0.3	0.4	0.3	–	0.3
Dead	–	–	0.8	1.5	1.0
Avg height to live crown (ft)	0.5	1.0	4.0	–	1.6
Live crown mass (tons/ac)	0.16	0.74	4.66	–	5.56
Aboveground mass (tons/ac)	0.23	0.98	12.33	9.02	22.56

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.5	4.38	100
Moss	1.9	2.90	53
Lichen	1.3	0.25	7
Conifer litter	1.1	1.10	33
Hardwood litter	0.8	0.12	7
Duff	6.6	97.64	100
Upper	3.4	22.83	100
Lower	3.9	74.81	82
Total Forest Floor	8.1	102.02	100

*Sample size (n) = 90

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.4	0.0	0.4	–	–	–
0.26 - 1.0	0.6	0.0	0.6	–	–	–
1.1 - 3.0	0.6	0.0	0.6	–	–	–
> 3.0	3.9	<0.1	4.0	102	5	107
Total	5.6	<0.1	5.6	102	5	107

ALASKA
WHITE SPRUCE PHOTO SERIES

A SERIES OF 12 SITES
WS 01 THROUGH WS 12

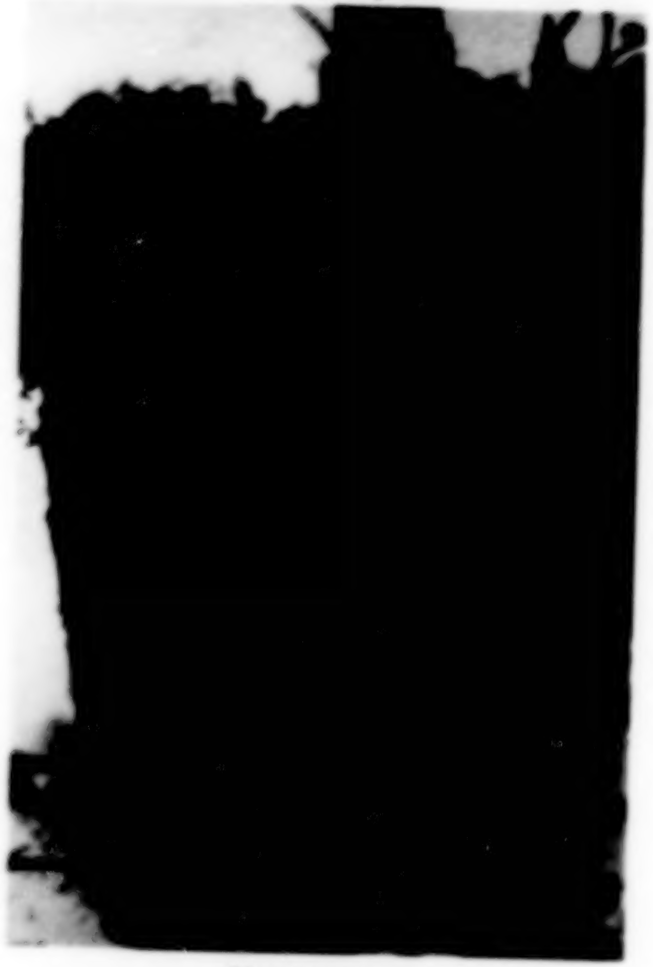
NOTES TO USERS:

1. The sites in this series are ordered from smallest to largest average tree diameter at breast height (d.b.h.).
2. A list of scientific and common species names can be found on page 6.
3. The marker in these photographs is a 1-foot square, and the pole is painted in contrasting colors at 1-foot intervals. The pole is 30 feet from the camera.
4. The sample shown in the forest floor profile photograph was taken from a random location in the sample area and does not necessarily represent the reported average forest floor conditions.
5. In the overstory summary table, live crown mass includes foliage and branches, while aboveground mass includes foliage, branches, and the bole.
6. A distinction is made between rotten and sound woody material for pieces larger than 3 inches in diameter.
7. Bulk density values used for calculating surface material loading from depth are:
    - Moss, lichen, and conifer litter: 2.9 tons·acre^{-1}·inch^{-1}
    - Hardwood litter: 2.3 tons·acre^{-1}·inch^{-1}
    - Grass: 0.30 ton·acre^{-1}·inch^{-1}
8. Bulk density values used for calculating duff loading from depth are:
    - Upper duff: 6.7 tons·acre^{-1}·inch^{-1}
    - Lower duff: 23.5 tons·acre^{-1}·inch^{-1}
9. Total unit biomass, woody material and forest floor loading, live crown mass, and aboveground mass are reported in tons per acre, while understory loadings are reported in pounds per acre.

WS 01 ALASKA WHITE SPRUCE

Wide view

Forest floor profile



SITE INFORMATION

Site location: N 64° 48' 41.41" W 148° 32' 09.63" 630 ft elevation

SAF covertype: White Spruce - Aspen
Vegetation type: Closed Quaking Aspen - Spruce Forest
Species: *Picea glauca, Populus tremuloides, Salix* spp., *Betula papyrifera*
Soil type:
Crown closure: 79% Hardwoods: 46% of stems

Total unit biomass: 90.33 tons/ac

UNDERSTORY

Tall shrub biomass: 1,973 lbs/ac Grass biomass: 24 lbs/ac
Low shrub biomass: 582 lbs/ac Forb biomass: 135 lbs/ac
Seedling biomass: 314 lbs/ac
Total understory biomass: 3,028 lbs/ac

Tall shrubs: *Salix* spp.
Density: 1,078/ac Standing dead: 3% Height: 9.1 ft
Seedlings: *Picea glauca, Populus tremuloides* and *Betula papyrifera*
Density: 3,714/ac Standing dead: 0% Height: 1.6 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*
Second most common species	*Populus tremuloides*	*Populus tremuloides*	*Populus tremuloides*	*Populus tremuloides*	*Populus tremuloides*
Tree density (stems/ac)	1,375	67	51	84	1,577
Live	1,308	67	34	67	1,476
Dead	67	0	17	17	101
Avg DBH (in)	0.7	2.7	8.0	12.7	1.7
Live	0.8	2.7	7.6	12.9	1.5
Dead	0.5	–	8.8	12.2	3.8
Avg height (ft)	7.9	20.3	33.3	56.8	11.8
Live	7.9	20.3	46.0	62.3	11.8
Dead	7.8	–	8.0	35.0	12.3
Avg ladder fuel height (ft)	1.8	3.8	3.5	13.0	2.4
Live	1.6	3.8	3.5	13.0	2.3
Dead	5.3	–	–	–	5.3
Avg height to live crown (ft)	2.8	5.5	7.0	16.5	3.6
Live crown mass (tons/ac)	0.82	0.46	3.50	26.29	31.08
Aboveground mass (tons/ac)	1.04	0.66	7.61	37.64	46.94

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.5	4.20	100
Moss	1.7	3.16	66
Lichen	–	–	–
Conifer litter	1.0	0.58	20
Hardwood litter	1.4	0.46	14
Duff	3.8	29.38	100
Upper	3.6	24.02	100
Lower	2.6	5.37	9
Total Forest Floor	5.3	33.58	100

*Sample size (n) = 90

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.3	0.0	0.3	–	–	–
0.26 - 1.0	0.4	0.0	0.4	–	–	–
1.1 - 3.0	1.5	0.0	1.5	–	–	–
> 3.0	3.1	3.1	6.2	146	131	277
Total	5.2	3.1	8.3	146	131	277

WS 02 ALASKA WHITE SPRUCE

Wide view

SITE INFORMATION

Site location: N 62° 02' 53.65" W 145° 27' 53.88" 1,380 ft elevation

SAF covertype: White Spruce
Vegetation type: Closed White Spruce Forest
Species: *Picea glauca*, *Salix* spp., *Populus balsamifera*
Soil type: Histic Pergelic Cryaquepts
Crown closure: 86% Hardwoods: <1% of stems

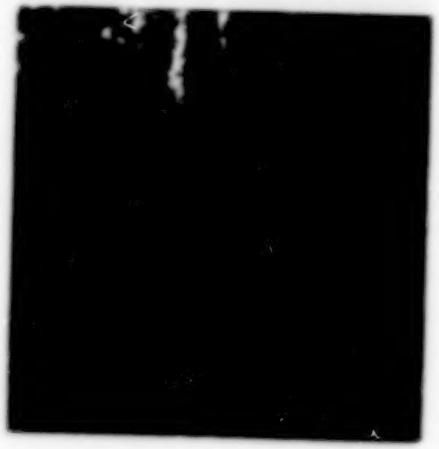
Total unit biomass: 248.02 tons/ac

Forest floor profile

UNDERSTORY

Tall shrub biomass: 643 lbs/ac Grass biomass: 0 lbs/ac
Low shrub biomass: 6 lbs/ac Forb biomass: 33 lbs/ac
Seedling biomass: 200 lbs/ac
Total understory biomass: 882 lbs/ac

Tall shrubs: *Salix* spp.
Density: 909/ac Standing dead: 100% Height: 6.3 ft
Seedlings: *Picea glauca* and *Populus balsamifera*
Density: 1,603/ac Standing dead: 100% Height: 2.1 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*
Second most common species	*Populus balsamifera*	–	–	*Populus balsamifera*	*Populus balsamifera*
Tree density (stems/ac)	4,496	2,650	638	17	7,801
Live	755	2,197	604	17	3,573
Dead	3,741	453	34	0	4,228
Avg DBH (in)	1.1	2.9	5.0	10.0	2.0
Live	1.6	2.9	5.0	10.0	3.0
Dead	1.0	2.6	4.2	–	1.2
Avg height (ft)	14.0	28.3	36.0	37.0	20.7
Live	20.4	29.3	36.2	37.0	28.6
Dead	12.8	23.4	32.0	–	14.0
Avg ladder fuel height (ft)	1.2	1.1	1.2	3.0	1.2
Live	1.3	1.2	1.2	3.0	1.2
Dead	1.2	0.9	1.5	–	1.1
Avg height to live crown (ft)	12.1	16.7	20.3	22.0	16.4
Live crown mass (tons/ac)	2.27	33.67	25.42	3.03	64.39
Aboveground mass (tons/ac)	6.79	38.94	31.17	3.10	79.99

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.7	4.90	100
Moss	1.8	4.68	88
Lichen	1.2	0.07	2
Conifer litter	0.4	0.10	8
Hardwood litter	1.1	0.05	2
Duff	9.4	160.19	100
Upper	3.6	23.90	100
Lower	5.9	136.29	98
Total Forest Floor	11.1	165.09	100

*Sample size (n) = 100

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.3	0.0	0.3	–	–	–
0.26 - 1.0	0.4	0.0	0.4	–	–	–
1.1 - 3.0	1.5	0.0	1.5	–	–	–
> 3.0	0.2	0.1	0.3	15	15	30
Total	2.4	0.1	2.5	15	15	30

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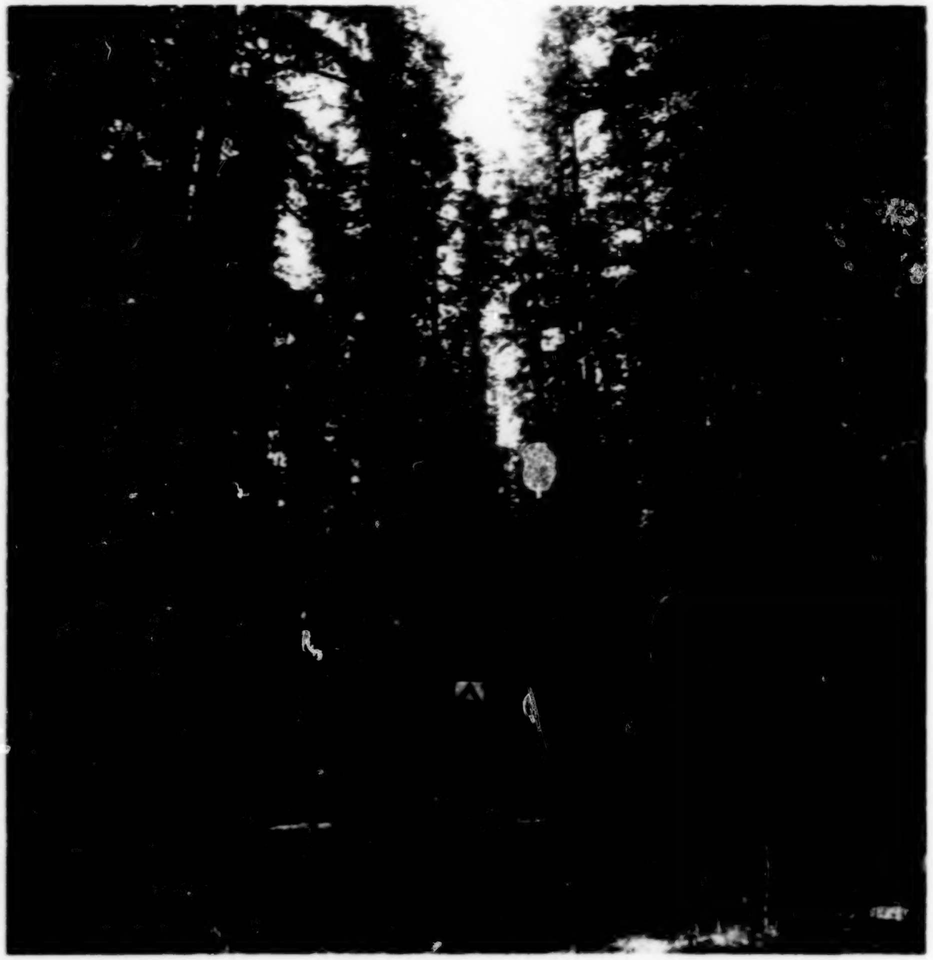
PAGE

WS 03 ALASKA WHITE SPRUCE

Wide view



Forest floor profile

SITE INFORMATION

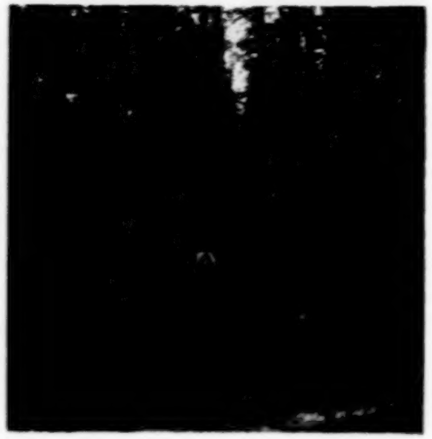
Site location: N 62° 04' 54.99" W 145° 26' 16.99" 1,430 ft elevation

SAF covertype: White Spruce
Vegetation type: Closed White Spruce Forest
Species: *Picea glauca, Picea mariana, Salix* spp., *Populus basamifera, Populus tremuloides*
Soil type: Histic Pergelic Cryaquepts
Crown closure: 78% Hardwoods: 3% of stems
Total unit biomass: 111.13 tons/ac

UNDERSTORY

Tall shrub biomass: 2,288 lbs/ac Grass biomass: 0 lbs/ac
Low shrub biomass: 13 lbs/ac Forb biomass: 4 lbs/ac
Seedling biomass: 314 lbs/ac
Total understory biomass: 2,619 lbs/ac

Tall shrubs: *Salix* spp.
Density: 872/ac Standing dead: 100% Height: 9.7 ft
Seedlings: *Picea mariana*
Density: 5,064/ac Standing dead: 23% Height: 0.9 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Populus tremuloides*	*Picea glauca*
Second most common species	*Picea mariana*	*Picea mariana*	*Populus balsamifera*	--	*Picea mariana*
Tree density (stems/ac)	3,758	1,879	739	17	6,393
Live	2,181	1,594	705	17	4,497
Dead	1,577	285	34	0	1,896
Avg DBH (in)	1.2	2.9	5.1	10.3	2.2
Live	1.3	2.9	5.1	10.3	2.5
Dead	0.9	2.7	5.0	–	1.3
Avg height (ft)	13.7	26.2	33.2	37.0	19.7
Live	15.5	27.3	34.3	37.0	22.7
Dead	11.3	20.2	11.0	–	12.6
Avg ladder fuel height (ft)	1.3	1.7	2.2	22.0	1.6
Live	1.3	1.5	2.2	22.0	1.6
Dead	1.5	3.7	3.0	–	1.8
Avg height to live crown (ft)	8.7	15.8	21.1	25.0	13.2
Live crown mass (tons/ac)	4.37	21.10	29.81	4.82	60.11
Aboveground mass (tons/ac)	6.05	25.63	35.75	4.90	72.34

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.1	3.08	100
Moss	1.5	2.18	50
Lichen	–	–	–
Conifer litter	0.6	0.56	30
Hardwood litter	0.7	0.34	20
Duff	3.4	30.90	100
Upper	3.0	19.91	100
Lower	2.6	10.99	18
Total Forest Floor	4.5	33.98	100

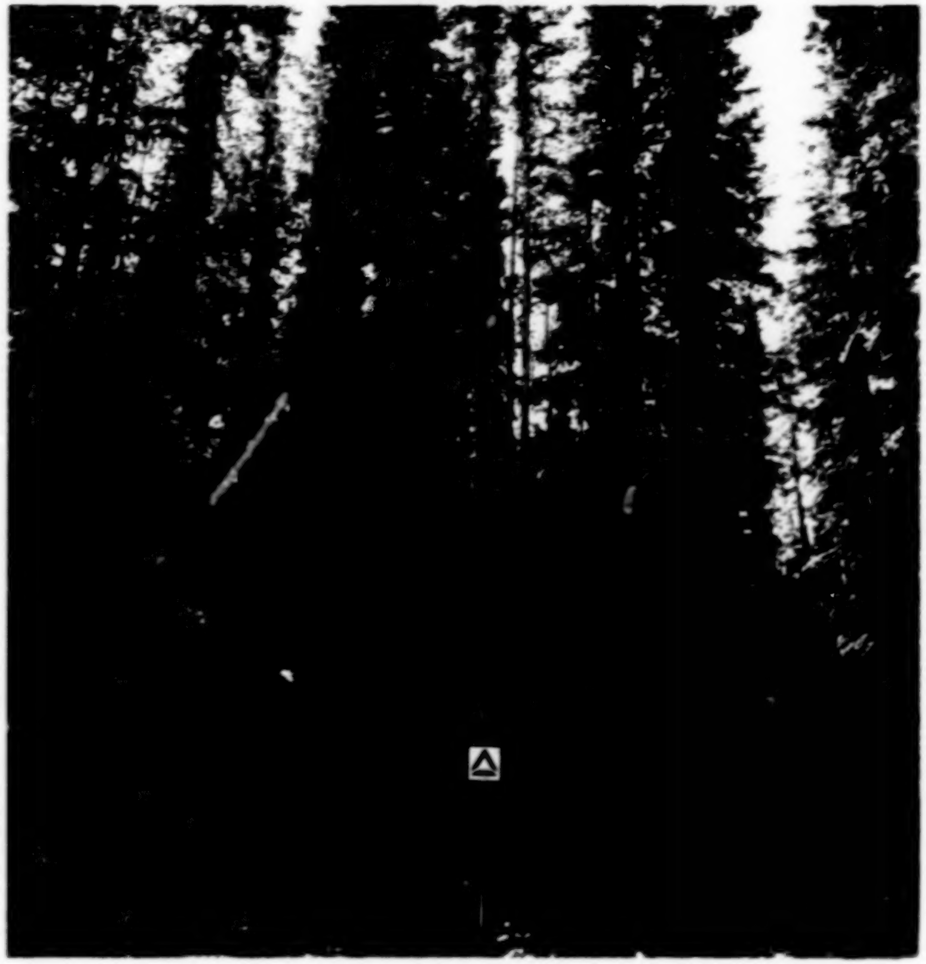
*Sample size (n) = 90

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.4	0.0	0.4	–	–	–
0.26 - 1.0	0.7	0.0	0.7	–	–	–
1.1 - 3.0	2.0	0.0	2.0	–	–	–
> 3.0	0.1	0.3	0.3	10	34	44
Total	3.3	0.3	3.5	10	34	44

WS 04 ALASKA WHITE SPRUCE

Wide view



Forest floor profile

SITE INFORMATION

Site location: N 62° 04' 54.16" W 145° 26' 16.30" 1,430 ft elevation

SAF covertype: White Spruce
Vegetation type: Closed White Spruce Forest
Species: *Picea glauca*, *Salix* spp., *Picea mariana*
Soil type: Histic Pergelic Cryaquepts
Crown closure: 80% Hardwoods: 0% of stems

Total unit biomass: 126.96 tons/ac

UNDERSTORY

Tall shrub biomass: 3,784 lbs/ac Grass biomass: 1 lb/ac
Low shrub biomass: 35 lbs/ac Forb biomass: 13 lbs/ac
Seedling biomass: 22 lbs/ac
Total understory biomass: 3,855 lbs/ac

Tall shrubs: *Salix* spp.
Density: 990/ac Standing dead: 91% Height: 9.6 ft
Seedlings: *Picea mariana* and *Picea glauca*
Density: 2,026/ac Standing dead: 25% Height: 0.6 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*
Second most common species	--	--	--	--	-
Tree density (stems/ac)	1,879	1,225	789	84	3,977
Live	537	1,124	772	84	2,517
Dead	1,342	101	17	0	1,460
Avg DBH (in)	1.1	2.9	5.3	9.9	2.7
Live	1.3	3.0	5.3	9.9	3.6
Dead	1.0	2.5	4.3	–	1.2
Avg height (ft)	14.1	28.1	41.0	58.2	24.7
Live	17.5	28.7	41.2	58.2	31.1
Dead	12.8	22.3	33.0	–	13.7
Avg ladder fuel height (ft)	1.3	1.3	1.7	1.0	1.4
Live	1.0	1.3	1.7	1.0	1.3
Dead	1.4	1.5	1.0	–	1.4
Avg height to live crown (ft)	10.7	16.9	21.6	22.6	17.2
Live crown mass (tons/ac)	1.19	17.00	41.26	16.85	76.31
Aboveground mass (tons/ac)	2.82	18.67	47.99	20.29	89.78

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.1	3.07	100
Moss	1.2	2.88	86
Lichen	–	–	–
Conifer litter	0.5	0.19	14
Hardwood litter	–	–	–
Duff	3.3	30.68	100
Upper	2.8	18.52	100
Lower	1.9	12.16	28
Total Forest Floor	4.4	33.75	100

*Sample size (n) = 90

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.3	0.0	0.3	–	–	–
0.26 - 1.0	0.5	0.0	0.5	–	–	–
1.1 - 3.0	0.6	0.0	0.6	–	–	–
> 3.0	<0.1	0.1	0.2	5	15	20
Total	1.4	0.1	1.5	5	15	20

WS 05 ALASKA WHITE SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 60° 29' 22.38" W 149° 56' 44.81" 500 ft elevation

SAF covertype: White Spruce
Vegetation type: Open White Spruce Forest
Species: *Picea glauca, Betulo papyrifera, Populus balsamifera*
Soil type: Typic Cryorthods
Crown closure: 33% Hardwoods: 17% of stems

Total unit biomass: 114.55 tons/ac

UNDERSTORY

Tall shrub biomass: 0 lbs/ac Grass biomass: 0 lbs/ac
Low shrub biomass: 0 lbs/ac Forb biomass: 548 lbs/ac
Seedling biomass: 49 lbs/ac
Total understory biomass: 597 lbs/ac

Tall shrubs: None
Density: 0/ac Standing dead: na Height: na
Seedlings: *Picea glauca* and *Betula papyrifera*
Density: 506/ac Standing dead: 0% Height: 1.9 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*
Second most common species	*Betula papyrifera*	*Populus balsamifera*	*Betula papyrifera*	--	*Betula papyrifera*
Tree density (stems/ac)	486	50	235	34	805
Live	486	50	168	0	704
Dead	0	0	67	34	101
Avg DBH (in)	0.6	2.5	6.7	13.3	3.0
Live	0.6	2.5	6.9	--	2.2
Dead	--	--	6.2	13.3	8.6
Avg height (ft)	6.8	12.0	40.5	30.0	17.9
Live	6.8	12.0	43.1	--	15.8
Dead	--	--	34.0	30.0	32.7
Avg ladder fuel height (ft)	0.4	0.0	6.9	2.0	2.2
Live	0.4	0.0	6.8	--	1.9
Dead	--	--	7.3	2.0	5.2
Avg height to live crown (ft)	0.4	0.0	9.0	--	2.4
Live crown mass (tons/ac)	0.17	0.27	15.80	--	16.23
Aboveground mass (tons/ac)	0.20	0.43	23.77	7.55	31.96

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.4	3.91	100
Moss	1.4	3.04	73
Lichen	--	--	--
Conifer litter	1.2	0.38	11
Hardwood litter	1.3	0.49	16
Duff	2.8	38.62	100
Upper	1.6	11.05	100
Lower	1.9	27.63	63
Total Forest Floor	4.2	42.59	100

*Sample size (n) = 99

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	1.0	0.0	1.0	--	--	--
0.26 - 1.0	1.6	0.0	1.6	--	--	--
1.1 - 3.0	3.3	0.0	3.3	--	--	--
> 3.0	29.4	4.4	33.8	1,046	268	1,314
Total	35.3	4.4	39.7	1,046	268	1,314

WS 06 ALASKA WHITE SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 60° 29' 19.69" W 149° 56' 20.24" 500 ft elevation

SAF covertype: White Spruce
Vegetation type: Open White Spruce Forest
Species: *Picea glauca, Populus tremuloides, Betula papyrifera*
Soil type: Typic Cryorthods
Crown closure: 52% Hardwoods: 25% of stems

Total unit biomass: 143.96 tons/ac

UNDERSTORY

Tall shrub biomass: 0 lbs/ac Grass biomass: 0 lbs/ac
Low shrub biomass: 1,650 lbs/ac Forb biomass: 124 lbs/ac
Seedling biomass: 116 lbs/ac
Total understory biomass: 1,890 lbs/ac

Tall shrubs: None
Density: 0/ac Standing dead: na Height: na
Seedlings: *Picea glauca* and *Populus tremuloides*
Density: 1,097/ac Standing dead: 0% Height: 1.5 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Betula papyrifera*	*Picea glauca*
Second most common species	*Populus tremuloides*	–	*Betula papyrifera*	*Picea glauca*	*Populus tremuloides*
Tree density (stems/ac)	302	319	436	67	1,124
Live	235	101	117	50	503
Dead	67	218	319	17	621
Avg DBH (in)	0.7	3.2	6.4	10.1	4.2
Live	0.5	3.4	5.7	9.9	3.3
Dead	1.4	3.1	6.6	10.7	4.9
Avg height (ft)	9.9	22.6	37.9	49.0	26.7
Live	8.3	24.0	31.3	42.0	20.2
Dead	15.5	21.9	40.3	70.0	32.0
Avg ladder fuel height (ft)	2.7	6.1	6.1	7.8	5.3
Live	2.7	3.7	4.1	8.3	3.8
Dead	2.9	7.3	6.8	6.0	6.5
Avg height to live crown (ft)	2.5	6.5	4.5	9.3	4.5
Live crown mass (tons/ac)	0.12	1.58	6.81	13.24	21.75
Aboveground mass (tons/ac)	0.25	4.65	34.86	21.43	61.18

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.6	4.46	100
Moss	1.7	3.02	63
Lichen	–	–	–
Conifer litter	1.3	0.99	26
Hardwood litter	1.7	0.45	11
Duff	3.4	44.86	100
Upper	2.0	13.65	100
Lower	2.5	31.22	54
Total Forest Floor	5.0	49.33	100

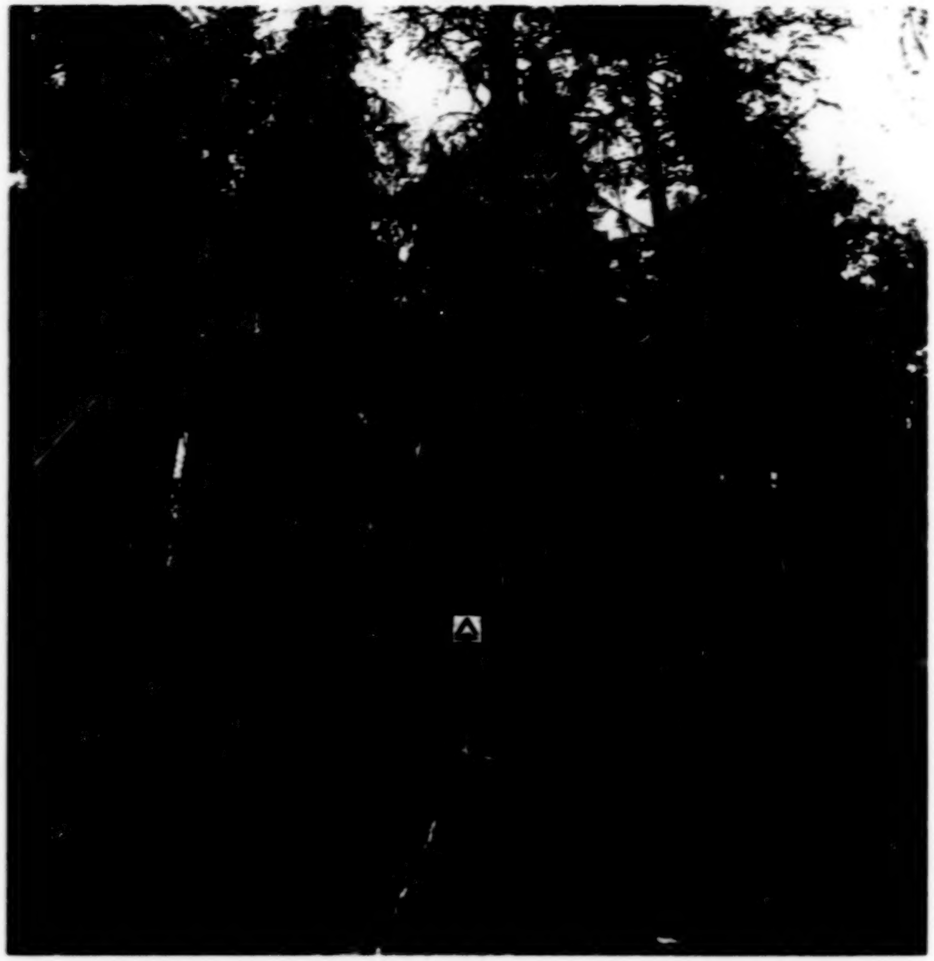
*Sample size (n) = 115

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	1.2	0.0	1.2	–	–	–
0.26 - 1.0	2.0	0.0	2.0	–	–	–
1.1 - 3.0	6.4	0.0	6.4	–	–	–
> 3.0	21.1	1.8	22.9	991	74	1,065
Total	30.8	1.8	32.5	991	74	1,065

WS 07 ALASKA WHITE SPRUCE

Wide view



Forest floor profile

SITE INFORMATION

Site location: N 60° 29' 18.04" W 149° 56' 18.08" 500 ft elevation

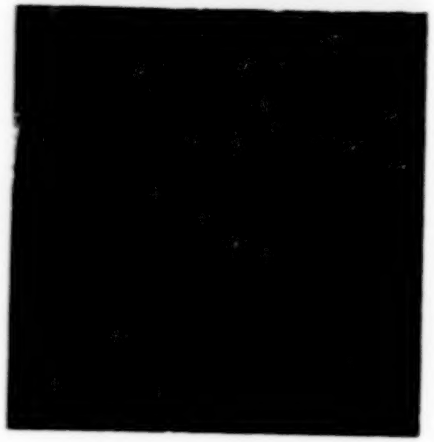
SAF covertype: White Spruce - Aspen
Vegetation type: Closed Quaking Aspen - Spruce Forest
Species: *Populus tremuloides, Picea glauca, Alnus sinuata*
Soil type: Typic Cryorthods
Crown closure: 63% Hardwoods: 75% of stems

Total unit biomass: 128.37 tons/ac

UNDERSTORY

Tall shrub biomass: 244 lbs/ac Grass biomass: 0 lbs/ac
Low shrub biomass: 448 lbs/ac Forb biomass: 73 lbs/ac
Seedling biomass: 234 lbs/ac
Total understory biomass: 999 lbs/ac

Tall shrubs: *Alnus sinuata*
Density: 135/ac Standing dead: 0% Height: 7.0 ft
Seedlings: *Populus tremuloides* and *Picea glauca*
Density: 2,363/ac Standing dead: 0% Height: 1.4 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Populus tremuloides*	*Populus tremuloides*	*Populus tremuloides*
Second most common species	*Populus tremuloides*	*Populus tremuloides*	*Picea glauca*	--	*Picea glauca*
Tree density (stems/ac)	101	168	671	117	1,057
Live	84	101	587	117	889
Dead	17	67	84	0	168
Avg DBH (in)	0.8	3.3	6.0	10.7	5.6
Live	0.8	3.2	6.2	10.7	5.9
Dead	1.1	3.3	4.5	--	3.7
Avg height (ft)	8.2	22.3	38.7	60.6	35.6
Live	8.6	25.3	40.4	60.6	38.4
Dead	6.0	17.8	26.7	--	21.1
Avg ladder fuel height (ft)	1.6	2.0	6.5	3.1	4.9
Live	1.8	0.5	6.8	3.1	5.1
Dead	0.5	4.3	3.8	--	3.6
Avg height to live crown (ft)	1.6	5.4	23.5	37.9	21.3
Live crown mass (tons/ac)	0.07	1.53	50.40	37.31	89.31
Aboveground mass (tons/ac)	0.09	2.74	56.37	37.85	97.05

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.1	2.61	97
Moss	1.1	0.34	11
Lichen	--	--	--
Conifer litter	0.7	0.31	14
Hardwood litter	1.2	1.96	72
Duff	2.7	20.81	100
Upper	2.5	16.88	100
Lower	2.9	3.93	6
Total Forest Floor	3.8	23.42	97

*Sample size (n) = 120

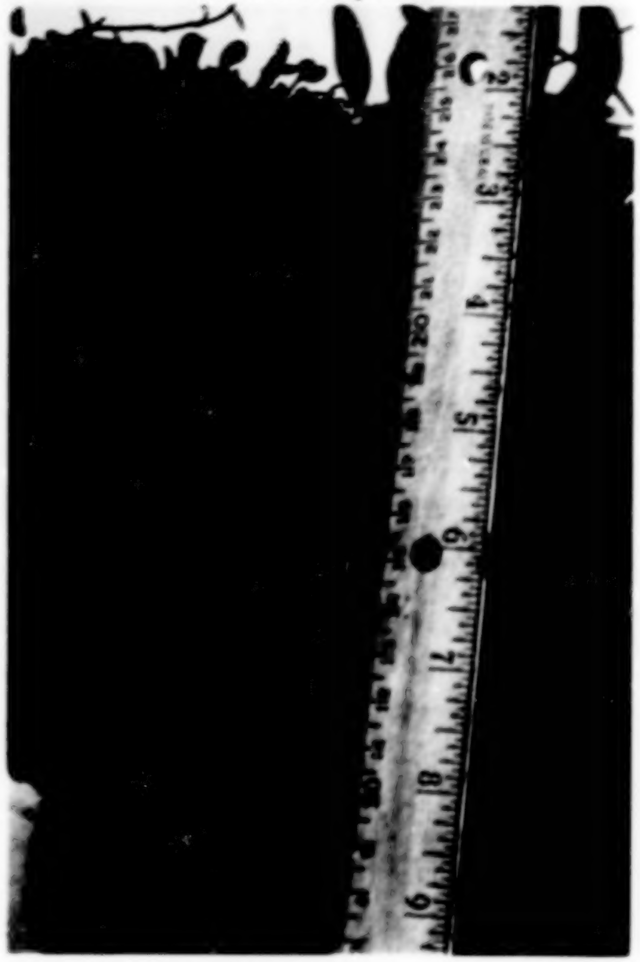
WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.5	0.0	0.5	--	--	--
0.26 - 1.0	0.8	0.0	0.8	--	--	--
1.1 - 3.0	2.1	0.0	2.1	--	--	--
> 3.0	2.8	1.3	4.1	151	68	219
Total	6.1	1.3	7.4	151	68	219

WS 08 ALASKA WHITE SPRUCE

Wide view

Forest floor profile



SITE INFORMATION

Site location: N 64° 49' 16.18" W 148° 30' 33.58" 770 ft elevation

SAF covertype: White Spruce - Paper Birch
Vegetation type: Closed Spruce - Paper Birch Forest
Species: *Picea glauca, Betula papyrifera, Populus tremuloides*
Soil type: Histic Pergelic Cryaquepts
Crown closure: 83% Hardwoods: 29% of stems

Total unit biomass: 178.50 tons/ac

UNDERSTORY

Tall shrub biomass: 0 lbs/ac Grass biomass: 72 lbs/ac
Low shrub biomass: 550 lbs/ac Forb biomass: 305 lbs/ac
Seedling biomass: 215 lbs/ac
Total understory biomass: 1,142 lbs/ac

Tall shrubs: None
Density: 0/ac Standing dead: na Height: na
Seedlings: *Picea glauca* and *Betula papyrifera*
Density: 929/ac Standing dead: 0% Height: 2.0 ft

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Betula papyrifera*	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*
Second most common species	*Populus tremuloides*	--	--	--	*Betula papyrifera*
Tree density (stems/ac)	235	34	235	184	688
Live	201	17	168	117	503
Dead	34	17	67	67	185
Avg DBH (in)	0.4	3.6	7.1	11.6	5.8
Live	0.2	3.1	7.0	12.2	5.4
Dead	1.2	4.0	7.3	10.6	7.1
Avg height (ft)	7.1	10.5	48.9	76.7	40.2
Live	6.6	15.0	53.0	89.6	41.7
Dead	10.0	6.0	38.8	54.3	36.2
Avg ladder fuel height (ft)	1.4	7.0	12.2	15.1	9.5
Live	1.4	7.0	11.9	14.6	8.2
Dead	–	–	13.0	16.0	14.5
Avg height to live crown (ft)	1.4	7.0	12.5	27.4	11.4
Live crown mass (tons/ac)	0.10	0.13	17.85	48.45	66.53
Aboveground mass (tons/ac)	0.15	0.36	26.19	68.63	95.33

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.7	4.77	100
Moss	1.8	4.49	84
Lichen	–	–	–
Conifer litter	0.6	0.20	11
Hardwood litter	0.7	0.07	4
Duff	5.3	62.23	100
Upper	3.8	25.29	100
Lower	4.3	36.94	37
Total Forest Floor	7.0	67.00	100

*Sample size (n) = 90

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.5	0.0	0.5	–	–	–
0.26 - 1.0	0.9	0.0	0.9	–	–	–
1.1 - 3.0	1.7	0.0	1.7	–	–	–
> 3.0	10.9	1.6	12.5	501	107	608
Total	14.0	1.6	15.6	501	107	608

WS 09 ALASKA WHITE SPRUCE

Wide view

Forest floor profile

SITE INFORMATION

Site location: N 60° 26' 27.33" W 150° 19' 12.94" 390 ft elevation

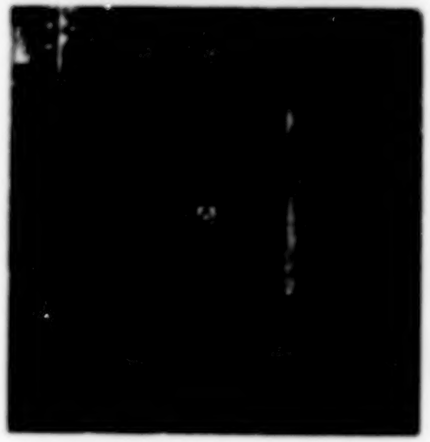
SAF covertype: White Spruce
Vegetation type: Closed White Spruce Forest
Species: *Picea glauca, Betula papyrifera, Alnus sinuata*
Soil type: Typic Cryorthods
Crown closure: 72% Hardwoods: 10% of stems

Total unit biomass: 170.84 tons/ac

UNDERSTORY

Tall shrub biomass: 2,066 lbs/ac Grass biomass: 96 lbs/ac
Low shrub biomass: 1,033 lbs/ac Forb biomass: 470 lbs/ac
Seedling biomass: 93 lbs/ac
Total understory biomass: 3,758 lbs/ac

Tall shrubs: *Alnus sinuata*
Density: 655/ac Standing dead: 0% Height: 9.1 ft
Seedlings: *Betula papyrifera*
Density: 84/ac Standing dead: 0% Height: 2.0 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*
Second most common species	*Betula papyrifera*	--	--	--	*Betula papyrifera*
Tree density (stems/ac)	100	68	151	168	487
Live	50	34	67	34	185
Dead	50	34	84	134	302
Avg DBH (in)	1.2	3.0	6.6	10.8	6.4
Live	0.5	3.2	6.7	10.2	5.0
Dead	1.9	2.8	6.6	10.9	7.3
Avg height (ft)	12.2	20.0	54.9	73.0	47.5
Live	9.0	18.5	64.3	72.0	42.3
Dead	15.3	21.5	47.4	73.3	50.7
Avg ladder fuel height (ft)	2.5	3.3	6.4	5.0	4.7
Live	2.0	2.5	4.0	6.0	3.6
Dead	3.0	5.0	8.8	4.8	5.4
Avg height to live crown (ft)	2.0	2.5	20.0	23.5	12.6
Live crown mass (tons/ac)	0.03	0.35	7.41	8.23	16.02
Aboveground mass (tons/ac)	0.20	0.84	15.49	48.09	64.63

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.5	3.90	100
Moss	1.5	2.45	55
Conifer litter	1.2	0.86	24
Hardwood litter	1.9	0.57	13
Grass	1.4	0.11	8
Duff	5.2	57.13	100
Upper	3.8	25.76	100
Lower	4.2	31.37	32
Total Forest Floor	6.7	61.03	100

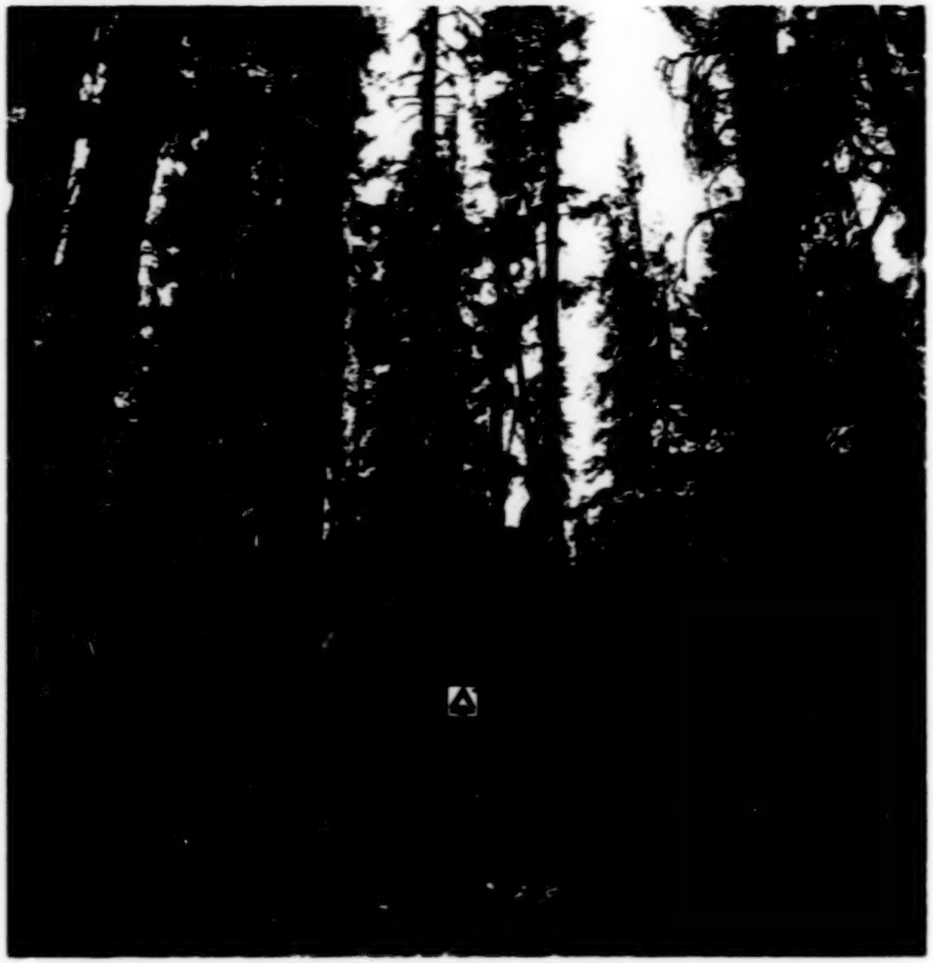
*Sample size (n) = 120

WOODY MATERIAL

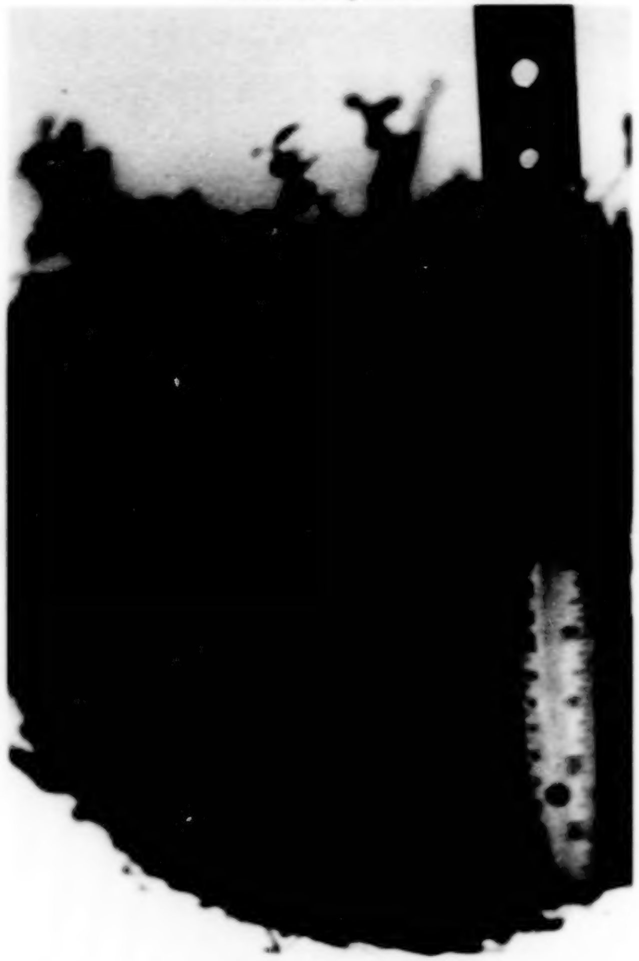
Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.8	0.0	0.8	--	--	--
0.26 - 1.0	1.4	0.0	1.4	--	--	--
1.1 - 3.0	1.5	0.0	1.5	--	--	--
> 3.0	35.6	4.0	39.6	613	146	759
Total	39.3	4.0	43.3	613	146	759

WS 10 ALASKA WHITE SPRUCE

Wide view



Forest floor profile



SITE INFORMATION

Site location: N 60° 26' 26.40" W 150° 19' 15.59" 430 ft elevation

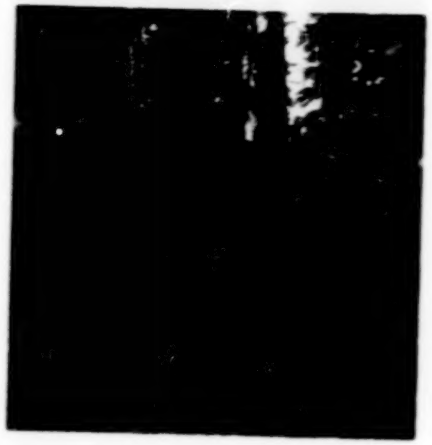
SAF covertype: White Spruce - Paper birch
Vegetation type: Closed Spruce - Paper Birch Forest
Species: *Picea glauca, Betula papyrifera, Alnus sinuata*
Soil type: Typic Cryorthods
Crown closure: 70% Hardwoods: 32% of stems

Total unit biomass: 193.23 tons/ac

UNDERSTORY

Tall shrub biomass: 1,825 lbs/ac Grass biomass: 7 lbs/ac
Low shrub biomass: 262 lbs/ac Forb biomass: 362 lbs/ac
Seedling biomass: 0 lbs/ac
Total understory biomass: 2,456 lbs/ac

Tall shrubs: *Alnus sinuata*
Density: 537/ac Standing dead: 25% Height: 9.9 ft
Seedlings: None
Density: 0/ac Standing dead: na Height: na



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Betula papyrifera*	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*
Second most common species	*Picea glauca*	--	*Betula papyrifera*	*Betula papyrifera*	*Betula papyrifera*
Tree density (stems/ac)	101	34	118	168	421
Live	84	17	84	101	286
Dead	17	17	34	67	135
Avg DBH (in)	0.4	2.7	6.1	11.2	6.5
Live	0.2	2.7	5.9	10.7	5.8
Dead	1.3	2.7	6.5	12.0	8.1
Avg height (ft)	5.8	18.0	42.9	51.9	35.6
Live	5.2	12.0	40.6	55.7	33.8
Dead	9.0	24.0	48.5	46.3	39.4
Avg ladder fuel height (ft)	1.4	1.5	7.9	11.3	7.0
Live	1.7	0.0	8.4	13.7	7.8
Dead	0.0	3.0	6.5	6.7	5.1
Avg height to live crown (ft)	1.7	2.0	17.4	23.5	14.0
Live crown mass (tons/ac)	0.01	0.07	5.75	25.84	31.67
Aboveground mass (tons/ac)	0.03	0.34	9.72	50.55.	60.64

FOREST FLOOR

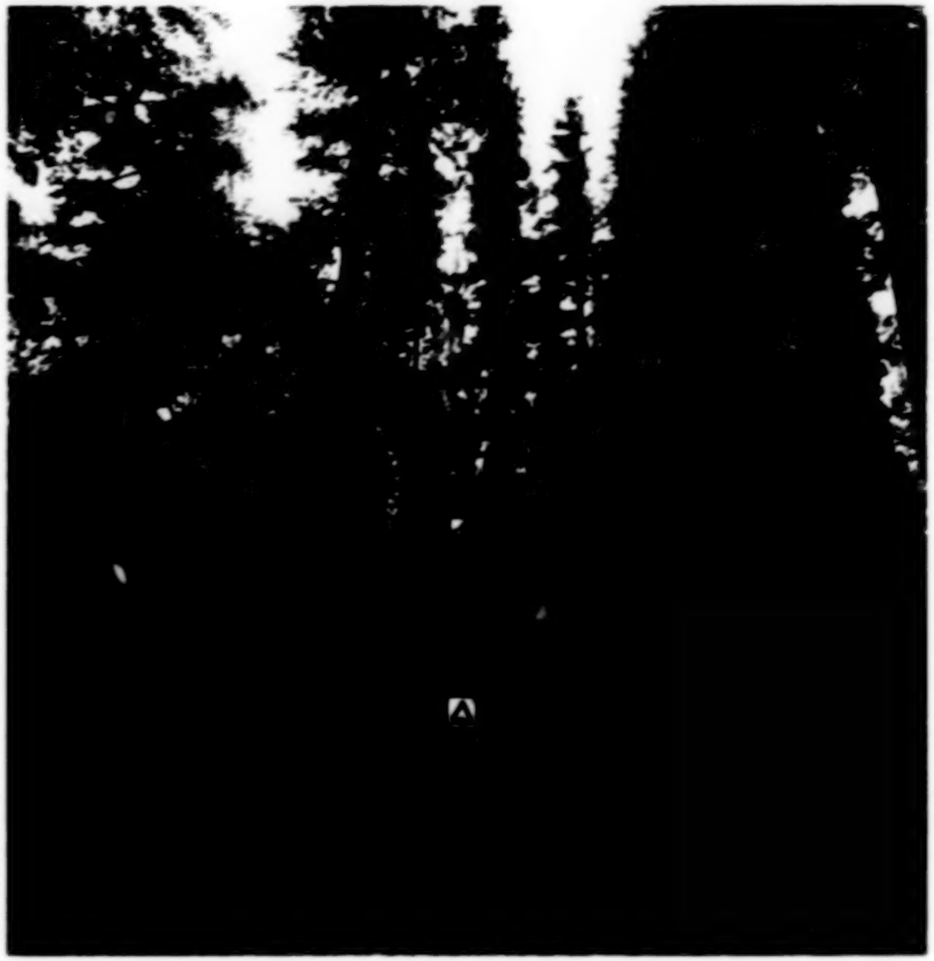
	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.1	2.93	100
Moss	1.0	1.03	33
Lichen	–	–	–
Conifer litter	1.0	1.21	45
Hardwood litter	1.4	0.69	22
Duff	5.3	77.83	100
Upper	2.9	19.12	100
Lower	3.3	58.71	75
Total Forest Floor	6.4	80.76	100

*Sample size (n) = 114

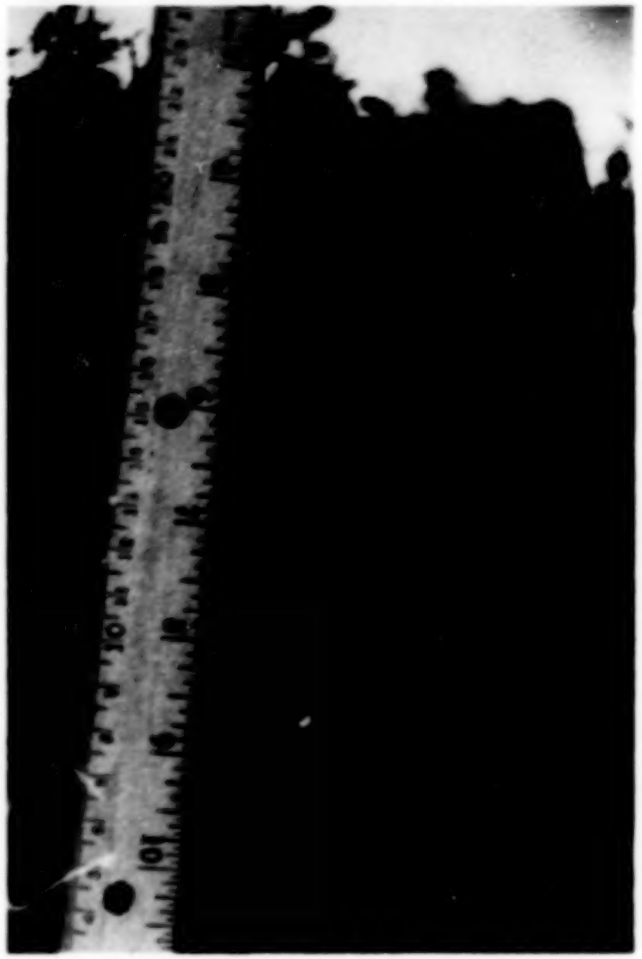
WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	1.0	0.0	1.0	–	–	–
0.26 - 1.0	1.7	0.0	1.7	–	–	–
1.1 - 3.0	3.3	0.0	3.3	–	–	–
> 3.0	37.5	7.0	44.5	779	112	891
Total	43.6	7.0	50.6	779	112	891

WS 11 ALASKA WHITE SPRUCE



Wide view



Forest floor profile

SITE INFORMATION

Site location: N 64° 46' 46.07" W 148° 41' 19.37" 450 ft elevation

SAF covertype: White Spruce - Paper Birch
Vegetation type: Closed Spruce - Paper Birch Forest
Species: *Picea glauca, Betula papyrifera, Alnus sinuata, Salix* spp.
Soil type: Histic Pergelic Cryaquepts
Crown closure: 80% Hardwoods: 25% of stems

Total unit biomass: 144.39 tons/ac

UNDERSTORY

Tall shrub biomass: 138 lbs/ac Grass biomass: 55 lbs/ac
Low shrub biomass: 360 lbs/ac Forb biomass: 120 lbs/ac
Seedling biomass: 0 lbs/ac
Total understory biomass: 673 lbs/ac

Tall shrubs: *Alnus sinuata* and *Salix* spp.
Density: 151/ac Standing dead: 0% Height: 6.1 ft
Seedlings: None
Density: 0/ac Standing dead: na Height: na

OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Betula papyrifera*	*Picea glauca*	*Picea glauca*	*Picea glauca*	*Picea glauca*
Second most common species	--	*Betula papyrifera*	*Betula papyrifera*	*Betula papyrifera*	*Betula papyrifera*
Tree density (stems/ac)	17	51	84	168	320
Live	17	34	50	134	235
Dead	0	17	34	34	85
Avg DBH (in)	1.4	2.9	6.2	11.8	8.5
Live	1.4	2.9	6.6	12.1	9.0
Dead	–	2.8	5.7	10.4	7.0
Avg height (ft)	9.0	20.3	30.6	64.3	46.5
Live	9.0	20.5	40.7	71.3	54.3
Dead	–	20.0	15.5	32.5	23.2
Avg ladder fuel height (ft)	0.0	3.7	2.8	7.5	5.4
Live	0.0	3.5	2.7	8.1	5.9
Dead	–	4.0	3.0	2.0	3.0
Avg height to live crown (ft)	0.0	5.0	6.0	12.4	9.3
Live crown mass (tons/ac)	0.03	0.35	3.96	46.94	51.27
Aboveground mass (tons/ac)	0.03	0.54	7.39	63.14	71.10

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.6	4.48	100
Moss	1.6	3.00	67
Lichen	–	–	–
Conifer litter	1.6	0.97	21
Hardwood litter	1.8	0.51	12
Duff	4.8	47.47	100
Upper	3.9	26.12	100
Lower	3.1	21.35	29
Total Forest Floor	6.4	51.95	100

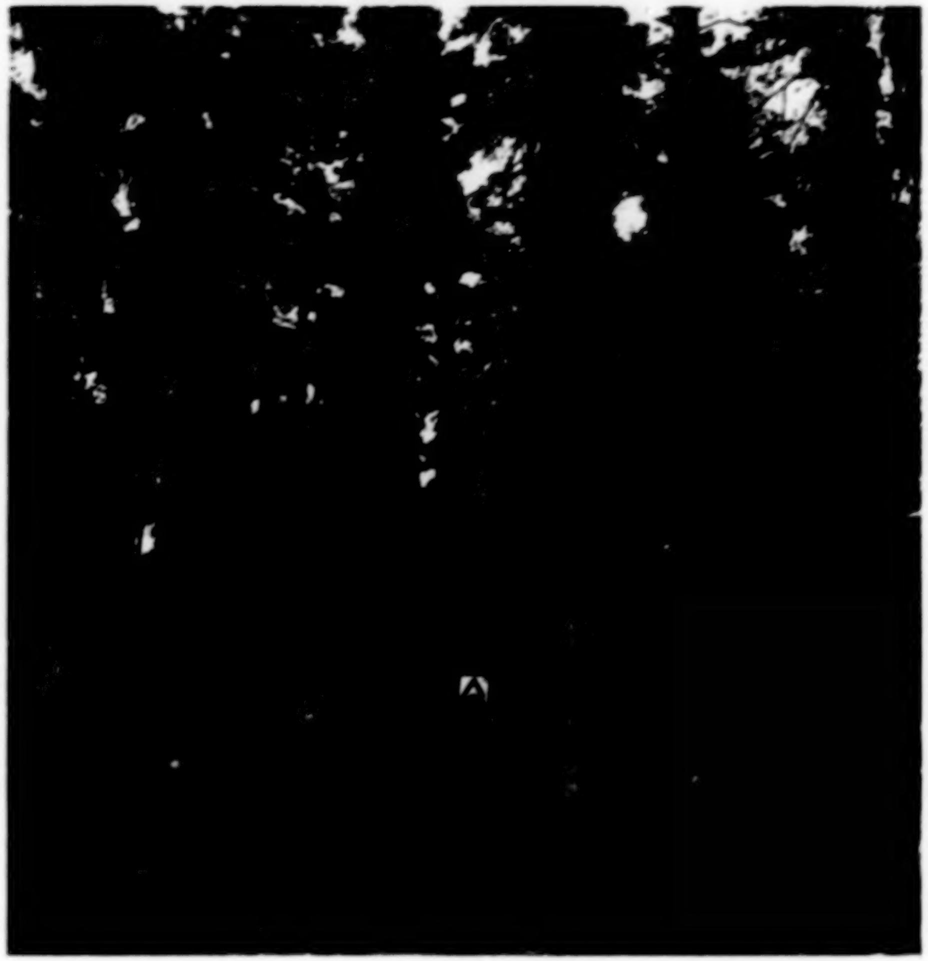
*Sample size (n) = 90

WOODY MATERIAL

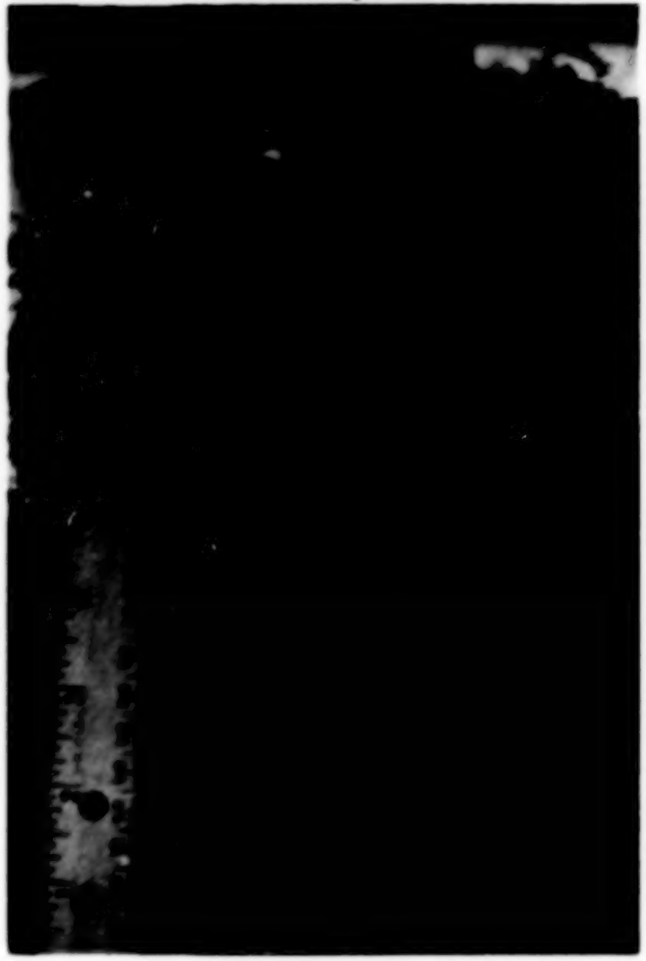
Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.4	0.0	0.4	–	–	–
0.26 - 1.0	0.7	0.0	0.7	–	–	–
1.1 - 3.0	1.7	0.0	1.7	–	–	–
> 3.0	7.5	10.6	18.2	263	336	599
Total	10.4	10.6	21.0	263	336	599

WS 12 ALASKA WHITE SPRUCE

Wide view



Forest floor profile



SITE INFORMATION

Site location: N 64° 46' 41.06" W 148° 41' 21.20" 450 ft elevation

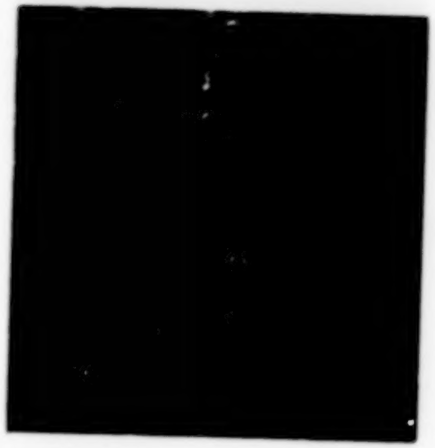
SAF covertype: White Spruce - Paper Birch
Vegetation type: Closed Spruce - Paper Birch Forest
Species: *Picea glauca, Betula papyrifera, Alnus sinuata*
Soil type: Histic Pergelic Cryaquepts
Crown closure: 88% Hardwoods: 45% of stems

Total unit biomass: 180.23 tons/ac

UNDERSTORY

Tall shrub biomass: 1,668 lbs/ac Grass biomass: 119 lbs/ac
Low shrub biomass: 595 lbs/ac Forb biomass: 481 lbs/ac
Seedling biomass: 39 lbs/ac
Total understory biomass: 2,902 lbs/ac

Tall shrubs: *Alnus sinuata*
Density: 941/ac Standing dead: 2% Height: 10.1 ft
Seedlings: *Betula papyrifera*
Density: 760/ac Standing dead: 0% Height: 3.1 ft



OVERSTORY

	Size Class (Diameter at Breast Height)				
	≤ 2"	2 - 4"	4 - 9"	> 9"	> 0"
Most common species	*Picea glauca*	*Picea glauca*	*Betula papyrifera*	*Picea glauca*	*Picea glauca*
Second most common species	--	--	*Picea glauca*	*Betula papyrifera*	*Betula papyrifera*
Tree density (stems/ac)	17	17	151	185	370
Live	17	0	67	151	235
Dead	0	17	84	34	135
Avg DBH (in)	1.9	2.9	7.9	12.6	9.8
Live	1.9	–	8.0	13.2	10.9
Dead	–	2.9	7.8	9.8	7.7
Avg height (ft)	10.0	20.0	39.1	64.3	49.5
Live	10.0	–	55.5	74.8	64.6
Dead	–	20.0	26.0	17.0	23.0
Avg ladder fuel height (ft)	1.0	–	14.6	5.8	9.4
Live	1.0	–	19.8	5.8	9.4
Dead	–	–	9.5	–	9.5
Avg height to live crown (ft)	7.0	–	21.0	9.7	12.7
Live crown mass (tons/ac)	0.05	–	10.93	71.03	82.02
Aboveground mass (tons/ac)	0.06	0.16	23.79	92.52	116.53

FOREST FLOOR

	Depth* (in)	Loading (tons/ac)	Constancy* (percent)
Surface material	1.4	3.60	100
Moss	1.8	1.66	31
Lichen	–	–	–
Conifer litter	1.2	0.30	9
Hardwood litter	1.2	1.64	60
Duff	4.6	44.05	100
Upper	3.8	25.48	100
Lower	3.1	18.57	26
Total Forest Floor	6.0	47.65	100

*Sample size (n) = 90

WOODY MATERIAL

Diameter (in)	Loading (tons/ac)			Density (pieces/ac)		
	Sound	Rotten	Total	Sound	Rotten	Total
≤ 0.25	0.6	0.0	0.6	–	–	–
0.26 - 1.0	0.9	0.0	0.9	–	–	–
1.1 - 3.0	1.2	0.0	1.2	–	–	–
> 3.0	8.5	3.4	11.9	180	131	311
Total	11.1	3.4	14.6	180	131	311

Ottmar, Roger D.; Vihnanek, Robert E. 1998. Stereo photo series for quantifying natural fuels. Volume II: black spruce and white spruce types in Alaska. PMS 831. Boise, ID: National Wildfire Coordinating Group, National Interagency Fire Center. 65 p.

Two series of stereo photographs display a range of natural conditions and fuel loadings in black spruce and white spruce ecosystem types in Alaska. Each group of photos includes inventory information summarizing vegetation composition, structure and loading, woody material loading and density by size class, forest floor depth and loading, and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

Keywords: Woody material, biomass, fuel loading, natural fuels, black spruce, *Picea mariana*, white spruce, *Picea glauca*, boreal forest, Alaska.

66

END

12-24-02